

AVIATION WEEK

A McGRAW-HILL PUBLICATION

APR. 25, 1955

50 CENTS

Forging ahead

IN PERFORMANCE

per-pound-of-wheel

per-pound-of-load

per-roll-mile

New Forged Airplane Wheels by Goodyear are delivering greater strength at spectacular weight-savings to the aeronautics industry.

Our pioneering work in forged magnesium wheels was undertaken to deliver wheels of record capacity per pound, greater "roll life" to meet the special needs of specific aircraft, such as long-range commercial, military, and particularly jet aircraft — "where every ounce and every pound counts!"

As a result of superior die-design and exacting quality control from billet to finished product, Goodyear's new forged wheels eliminate fatigue "footholds" by the very excellent simplicity of their contours — and deliver an average weight-saving of 15% over conventional cast magnesium wheels.

Currently in production for Grumman F9F-9, Douglas DC7C, and other airplanes — Goodyear Forged Wheels have already proved their value to specific aircraft where poundage and performance are of prime importance.

For full facts on forged wheels, another weight-saving advancement by Goodyear — write:

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Are You Interested In WEIGHT REDUCTION?

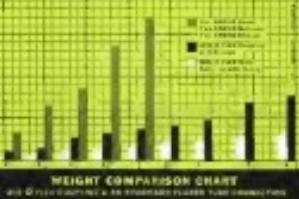
WIGGINS COUPLINGS
SAVE 15 POUNDS
ON LOCKHEED C-130

America's first turbo-prop transport—the Lockheed C-130...
is 15 pounds lighter because WIGGINS COUPLINGS
replaced standard AN connections and cut back
WIGGINS COUPLINGS weigh 1/3 as much
as the standard AN connections they can replace.
(See Weight Chart for exact comparisons.)

WIG-O-FLEX COUPLING



Flexible union for connecting
rigid tubes



Washington Roundup

No Subsidy Payments?

Cord Antennae Board is likely to run out of funds for subsidy payments shortly. The Board set an requirement for payments between now and the end of the fiscal year, June 30, at \$35.2 million. Congress voted only \$3.9 million.

It's a question as to which carriers will be forced to go without their subsidies.

• According to CAB Member Chet Garner, the Board is obliged under the 1958 Civil Antennae Act to make payments to all carriers in certain the one-time CAB cost of service.

• He claims engineers, in a report, showed that the entire \$3.9 million can't be used for payments to local service carriers. This process—which would mean that the entire \$3.9 million can't be used—money would be applied to other domestic and international carriers—in not written into legislation.

Three questions are raised:

How much weight will CAB give a congressional act amendment?

Are carriers entitled to payments, determined by CAB under the authority of the 1958 CAA Act, and uninsured as to what to do?

Meanwhile, industry leaders hope CAB will make another effort to obtain funds from Congress.

Opinions by Newbury

Unusually by hostile industry and military reaches to his proposal that defense engine developments be restricted to units of standard size and thrust, Defense Department's assistant secretary for Applications Engineering Frank D. Newbury now appears to be warming the cause among industry with a skeptical eye on its stability. Newbury said last week:

"The most serious limitation of progress in our overall defense posture, especially in the development field, is the scarcity of qualified research and engineering and production manpower."

Objectives of the Office of Applications Engineering Newbury said are:

• A policy of concentration of effort on a smaller number of major developments to conserve our limited research resources of qualified engineering manpower and industry.

• A policy of consolidating engineering experience in the military departments along with consolidation of development facilities.

• A policy of extending the assignment in a single service of responsibility for the development and procurement of a specific type of equipment that will be used by more than one service.

• A policy of awarding initial production contracts to the contractor who developed a new device and was reasonably to the lead.

Noteworthy features, that Rossouw had technological emphasis in due to its ability to focus development.

"If we can live the assignment rate to the USSR," he said, "with my more limited technical and industrial resources, it will be because the USSR has of necessity preferred a policy of selection of its objectives and concentration of its enormous concentrations on heavy industry in support of economic goals, and concentration on a relatively low ratio and range of weapons and equipment in its military program."

The assistant secretary revealed that a comprehensive

study of aircraft armament that is under way with the goal of streamlining some of the 30 different types and sizes of aircraft armament used by Navy and Air Forces.

Homonon to Pentagon

R. Karl Homann, now appears certain to take over job in head of the Pentagon's security program, Major Project of Civilian Engineering Group of Bureau of Strategic Information, a job for which he was chosen by the White House, he is working in Defense Department office and is expected to be made an officer to replace Major D. Walter Lewis, who has returned to United Air Lines from his post as Deputy for Public Affairs to Aviation Secretary Robert T. Brown (AW, Apr. 16, p. 110).

Talking with Homann, contractors and the press will find a veteran engineer with broad experience in the field of technical publications. On loan from Bell Telephone Laboratories, where he is Director of Publications, Homann worked on supersonic engine design in Washington during World War II. He joined AT&T's research laboratory 1919 and has been with the company ever since. His activity at OSEL, where he went last November, appears to have been well received, if not fully understood, by the problem of defense. That leads to the problem of security, which board with diplomatic efforts to maintain the flow of sensitive information. In his new job, he will have direct power to approve or disapprove release of information. Major headache will be interpretation of Defense Secretary Charles E. Wilson's order that material given out must be "restrictive" in its contribution to the department.

Permanent Feeders

The White House is expected to go along with legislation directing Civil Antennae Board to give permanent certificates to the 14 local service stations. It passed both House and Senate by voice vote.

The Republicans support for the measure in the Congress, as well as the Democrats, is overwhelming. Rep. Carl Shoup, high ranking Republican on the House Commerce Committee, predicts that both houses would overwhelmingly to rule a presidential veto.

Although Commerce Department and Civil Antennae Board have taken official position in opposition to the legislation, Under Secretary of Commerce for Transportation Louis Rabinow, Assistant Secretary of Commerce for Small Business and CAB's new chairman, Ross Reiter, are not expected to put up strong opposition to a veto. The former Commerce Secretary, Fletcher Wren, told the full bill for a veto, and if he does, his position is not expected to prevail.

Contract Publicity

Defense Department is forced to work out a program of advertising contracts that is somewhat limited. The main restriction was made by Sen. James Duff of the Senate Committee on Small Business and given enthusiastic support by Assistant Secretary of Defense Thomas Pile.

Duff concerned with Pile that procurement items for aircraft and guided missiles do not lead themselves to competitive bid contracting. "But there is a public impression that negotiated contracts are being passed out under the table in interviews," Duff commented. "And that public opinion has got to be eliminated." Pile and the advertising program would be "more!"

—Washington staff



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Marman products are manufactured under various U. S. and foreign patents and other patents pending.

New Cost Plan Threatens Incentive Pay

Proposed new ASFR Section XV would liberalize government treatment of research project expenses.

By Claude Wate

Showdown between U.S. Air Force and major aircraft manufacturers over the question of cost allowability of profit-sharing and stock bonus plans appears likely last week in a lengthy study proposed recently in Section XV of the Armed Services Procurement Regulation.

Immediate reaction of industry to the proposed changes was that all incentive pay plans are threatened in the photos of companies that do more than all of their business with the Defense Department.

USAF, because of the armed forces' strict discipline of profit-sharing expense as part of the costs to be reimbursed on surplus fuel oil contracts, indicated no final decision has been reached. It is expected that uniform treatment of the subject will come from application of USAF, Army and Navy conversion officials as how the new regulations will be applied.

Cross of the stick appears to be a proposed regulation that says cost of profit-sharing plan will not be allowable if the amount of the incentive at the time of entering into the contract is less than 75% with non-governmental customers, taking into account the amount of the contract in question. Only exception would be through special contract provision.

Restrictions

Restrictions on which profit sharing would be an allowable cost are succinct, along with, by their very nature:

- They must be paid under an agreement made before the work is performed and before an established plan is in no obligation to the contractor.
- They may not be reasonable.
- They must be paid for current services only.
- They must be available to all employees or at least all within a cost accounting classification.
- They must be allowable for tax purposes.
- They must not be restricted to stockholders.
- They must not exceed 15% of the

May 23 in deadline for receipt of their opinions.

New Section XV represents a leg expansion of the old rules with emphasis on classification and the provision of a maximum allowed incentive payment to stockholders. Each state of cost that is covered is defined, with a statement as to extent of allowability, costallowables and whether payment must be made to the contractor or profit sharer.

Industry reaction to these restrictions is that they fail to make proper distinction between "splitting a mission" and true incentive compensation. Fearing that the new rule will result in disallowance of all incentive payments in firms during a long slate of defense work, they point out that bonus plans are standard bonuses for the stabilization of personnel at all levels.

General contract-defined, with enough flexibility to include "blow dry" projects is recognized as a basic job activity that must be honored. In just Air Force contracts, costs for this work will probably exclude only those not included in agreement.

Liberalize R & D

The proposed revision of Section XV has been circulated to ten major defense contractors, including Avco, Lockheed, Arm, and the Radio-Electric and Television Manufacturers Assn., as concerned. Defense Department has yet

ASPR Principles and Standards

These are the basic principles and standards used by the Defense Department in drafting procurement regulations. Armed Forces Procurement Regulation.

- **Cost**: Definition of total cost. The total cost of a procurement type contract is the sum of (1) the allowable direct costs, (2) the properly allowable portion of allowable indirect costs, (3) applicable income and other credits.
- **Factor affecting allowability of costs**: The factor to be considered in determining the allowability of costs include (1) reasonableness; (2) application of generally accepted accounting principles and practices; (3) existence of good business judgment in sense of cost; (4) sufficient definition in the established position of the contractor which substantially certifies the contract costs; (5) limitations as to types or amounts of cost that are set forth in this part 2 of section XV or otherwise included in the contract.
- **Credits**: The applicable portions of sense and other credits, which allowances, net represent benefits accruing to the contractor and which are related to any allowed cost will be credited to the government either as a reduction in contract cost or by a cash refund, as appropriate.
- **Contractor's accounting system**: The requirements concerning record keeping and reporting of the contractor's accounting procedures and practices are set forth in the "words clause" (See ASFR 7207).

- The amount is reasonable.
- Costs are reasonably allocable to off-work of the contractor rather than an independent general and related to such.
- The contractor agrees to divulge to the government the results of each job and research.

The losses of the contractor in the time of entering the contract a predominantly (75% or more) with non-governmental customers. It is less than 75% at the time of entering into the contract allowing may then be authorized to a special provision in the contract.

Related research is declared as work that is directed at the production of something useful. In this case, profit will be allowed if allocated on the basis of all production.

Other highlights from the proposed procurement regulation revision include the following:

- **Selling and distribution expenses**: generally are not allowable. However, there may be an allowance for the work of sales or departments providing technical consultation and other "household services."
- **Advertising expense**: rates are unchanged. Payment is allowable only for trade and technical journals reliable for dissemination of information in the industry and for help wanted advertising.

• **Building expenses**: will be treated as capital expenses and allocated on the basis of all hours of the contract utilization.

• **Carrying and storage losses**: are generally allowed only on the basis of calculated amounts, less by their costs allowed when losses are reduced within contract duration.

• **Civil defense expenses**: are allowable only if reasonably foreseeable.

• **Commissions and donations**: are allowable. The results of a general in policy, and is a change that was approved by the government's General Accounting Board.

• **Depreciation**: sections of the ASFR has been greatly expanded in an effort to keep defense plants more up-to-date. New accounting methods of the Internal Revenue Code have been adopted covering an aggregate total taken to the plant cost. USAF Costs are allowable and linked depreciation is permitted in the early years of using all the cost of funds.

• **Rental of plant and equipment**: are allowable with limitation. This includes those items against transfer of title or lease, unless the cost of such rental is not the overall cost of the facility.

• **Insurance indemnification**: is allowable when the coverage is demanded by the government. Other insurance is allowable only if approved by the customer or the coverage and cost is reasonable under the circumstances. The section will



LUDWIGSBURG'S SUPER CONSTELLATION, first eight released from Lockheed Aircraft Corp., makes its delivery flight from Frankfurt, West Germany. Recently, Boeing's 1954 North American jets took off with their flight per week scheduled in July.

Costs allowed for use and occupancy expenses, however, will in principle be limited so as to exclude coverage of profit, interest, federal income taxes and an array of other items of expense unrelated to this part.

• **Interest and other financial expenses**: are not allowable except for interest assessed by state or local living authorities.

• **Materials and supplier allowances**: clearly defined, as well explained going with the cost of various components.

One interesting feature of the proposed regulation that when on item is brought in the contractor frame another division or plant of the same firm the price must not exceed that given the most in cost to that plant or available from another supplier.

• **Pension and retirement plans**: plans are based on minimum law and state and General purpose is to encourage that companies with pension plans make an annual figure limit, a six digit figure with proper justification for the government in allowing reasonable cost of costs.

• **Reimbursement**: expenses, general when the plant cost is reduced to the contractor during working before work was started on a similar contract are not allowable except when the provision is specifically provided for in the original contract.

• **Rents of plant and equipment**: are allowable with limitation. This includes those items against transfer of title or lease, unless the cost of such rental is not the overall cost of the facility.

The 1954 savings rate was 1.5% on sales.

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Aircraft Earnings

Total 1954 earnings of 13 major U.S. airplane manufacturers amounted to \$162.6 million on sales of \$4,926.7 million, according to the Aircraft Industries Assn.

Basis of the figure is 1953 and was approximately \$224 billion. This shows that the 1954 figure is a return to the 1953 level, a change attributed to the fact that the industry has earned the reduced production plateau.

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Convair F-102A's Supersonic Shape

Knick-kneed and supersonic, Convair's F-102A dashes through the Southern California skies, drawing from the form that made it supersonic in level flight. Changes in leading and trailing edge shape, plus more power from an PW-AWA 377, dropped the dog and lowered the speed over the Mach 1 mark. Wing leading edges were changed to expose the forewing edge of flight. Tail blisters help reduce flow breakdown at the fighter's critical wing half-leading position.



AVIATION WEEK, April 25, 1965

SAE Holds 1955 Aeronautic Meeting

There is a prime reason for having an engineering society meeting: to discuss new problems with old friends.

Last week in New York, during its Golden Anniversary year, the Society of Automotive Engineers staged its aeronautic meeting, engineering display and production forum.

More than 1,000 engineers, highest attendance in SAE's 50 yr. history, pondered the problems of powerplants, aircraft structures, aircraft control and design, and the exotic fringe of boundary layer control, heating factors and noise.

Propulsion program dominated the first three days' sessions, with air transport a close second.

We know where we are going in propeller development, but we're not sure how to get there.

The reason: There are about \$30,000 possible ways of approaching future engine professors, W. G. Lounsbury, our president at Wright Aeromechanics Division, told the SAE.

But several stand out as immediately obvious. Increasing airflow per unit massflow, while maintaining operating temperatures and lowering specific weights and fuel consumption.

This means reductions and reoptimization: bigger single engines rather than multiple powerplants; high temperature materials; rubber-blade cooling; lighter aircraft and possibly higher compression ratios.

A cold-flow simulation was one of the major efforts of the Allison Thermojet, and engineers J. B. Whitley, D. G. Zwernicki and R. W. Hicks. By simulating a cold engine, they would be free of vibration, the turbine shaft frequency. If the engine were shut down and restarted suddenly, the cold-flow would add up to an unacceptable load. The trouble was traced to a turbine heat bearing support structure that was sensitive to temperature changes.

Bristol's BE 35 supercharged turbo-prop will produce more power in the future than the turbine can use, because of Mach number limitation and Dr. Stanley Hodder, chief engineer of Bristol's engine division. In order to exploit the new engine field, he said, a new aircraft must be made available.

Bristol's development program is designed to reach 3,500 ft. min. power at 33,000 ft. Its turboprop power can be kept constant at 6,000 ft and constant at the end.

Forefield experiments with the light night, high-thrust J34 turboprop has shown the feasibility of such a configuration, according to A. T. Ergenek, chief engineer for research and advanced engineering of Fairedale's Engine Division.

Originally conceived for expandable use on transports and bombers, the de-rotated canards have also been used on Bell's STOL, testbed and as jetisonable tailfin units on the Fairchild's C-82 and C-119. A future possibility: Auxiliary power units for boundary layer control, he says.

► **Motors.** Motors—Explosive projectiles are good for remote applications, because they can be obtained quickly and at lower cost, and J. D. Rogers, of Westinghouse's Aviation Gas Turbine Division.

No, they aren't, and a Navy study suggests. Experience has shown the development time and cost is about the same as for a non-explosive engine. It's too expensive to exceed the cumulative 30 hr. life at service, he added.

At some 30 lb. in weight, a gun is probably able to do development, and a General Electric engineer is down-pacing fuel for non-explosive uses and there goes the short-life concept.

French and British Techniques

Prediction quality is the real key to the success of British and American programs, between U. S. and foreign engineers. Whitton Collier, chief enginier of Courtlandt Aviation & Engineering Corp.'s Gas Turbine division, told a panel session. By our standards, French seem slow down and extend research, he said, and the world would prefer to an acceptable level. The trouble was traced to a turbine heat bearing support structure that was sensitive to temperature changes.

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The French are experts in prototype development, Collier said. Their system for development has four specific advantages:

• Innovative development contracts when better performance is built in to a program.

• Flexibility of design open. Only a single design report is prepared for a single comparable offset from the monitoring agency.

• No need for synonymous component development before first series of aircraft is built, made up in part by parts produced on similar or scaled components.

• Dominance of the engine manufacturer over the airtframe and military representatives for the innovative design stage.

• British aircraft—Big advantage of the British engine industry is the extreme compactness of their experimental stage personnel, who are able to produce parts, make measurements, tool and produce pilot gearboxes and Avroval Readings.

Other advantages cited by the Englishman: preliminary design draft.

• Emphasis on getting a prototype in gear in shape to evaluate at full potential.

• Better supplier relations because the firms are smaller and time to be on.

• Steeper airtframe development, allowing time for tailoring the engine to the plane.

Tast differences between British and U. S. engines were discussed at length by H. W. Praga, manager of H-7 and J77 engine projects for the General Electric Co.'s Aircraft Gas Turbine Division.

Significant differences British claim are engine life for first flight after 25 hr ground running, not necessarily at full



REPUBLIC XF-84H subjected to vibration tests. This is first pulse of new cycle.

specification rating; we ask for 10 hr and full rating.

That rating, on acceptance tests, is averaged over the first 20 engines in Block I, and acceptable figures are given as 4% below the type rating. Here, each engine must qualify at full rating.

General machinists were first interested

engine developers had a better time of it, with more financial backing of development work, more highly skilled machinists and mechanics, and less rigorous, less-eccentric test and qualification requirements.

Many that day U.S. engineers recognized that one or another portion of the Block program be adopted here.

Military Transports Expanding

Air transport for the military services is headed for rapid expansion, ranging from front-line tactical movement of troops and supplies to shipment of war materiel to distant areas of combat operations to intercontinental logistics.

As outlined at the military transport session of the SAF, the services create many new requirements in helicopters, fast-jet transports, cargo aircraft and passenger planes.

Helicopters

Helicopters have become a primary aerial vehicle for the Marine Corps, according to Col. K. B. McCullough, director of the Corps' component board. After listing a multitude of battle uses, he pointed out that "it is in amphibious operations that the Marine Corps is primarily interested in applying these helicopters," techniques.

Assault landing forces of the traditional type would do as ideal targets for an enemy equipped with nuclear weapons. Known experience, however, showed that the helicopter provides a new dimension of transportation, enabling the Marine to conduct a landing operation from a point of contact, moving and dropped task forces without previously concentrated targets for atomic weapons (AW July 14, 1962, p. 16). From cooperating, coordinated street corner, helicopters could rapidly scan an attack force on selected enemy objectives.

Turboprop Aircraft

Assault to meet Rhine's specifications are in part on the way, according to paper delivered by Capt. Richard D. Clegg, Douglas' director of the C-130 Hercules, which was represented as "two-thirds less massive, but three times as powerful" as the piston-engine transport, having equivalent gross weight. Capt. Clegg cited these criticisms in Phase One of USAF's turboprop development:



CARGO HOST for Douglas C-130 cargo plane manufactured by O & M Machine Co., Inc.

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GE-3050 PLANE by Wyman-Gordon

- ♦ Douglas XC-130, powered by P&W XT37 engines, with a heavy transport design goes weight for transporting supplies directly to overseas theaters.
- ♦ Douglas XC-130A, powered by P&W T53-P-11, with a minimum design gross of 255,000 lb, for long-range transportation of cargo only.

Piston flying controls of running turboprop engines in conventional aircraft. Cessna's YC-141A, Bertrand's YC-91, and Douglas' YC-121P. Performance, performance of the YC-121A, exceeded its piston-blown (25%), climb (30%), cruise (35 to 40%) and payload over piston-engined version.

Phase One test of Convair's 307-51 was discontinued after 80 hours of flight because of inability to control propeller and turbine speeds.

Phase Two, which is continuing with turboprop engines mounted in the Republic XP-800 and the Boeing XB-47D, also included the McDonnell XP-80. The XB-47D test is to determine the feasibility of high-altitude, long-range transports without using both turboprop and turboshaft engines.

Airline Helicopter

Total operating costs of helicopter on short-haul routes will be lower than those of fixed-wing transports by 1965.

With economic expansion, passenger loadings will begin to share with the nonstopography of surface transports as routes up to 250 miles and, within the next 30 years, take the bulk of traffic away from railroads and motor buses.

These forecasts were made by George H. Alschuler, director of special programs for Air Transport Ass'n. Discussion of Air Transport Economics, at

the helicopter session of the Society. In the future, on short-haul transports, however, Midwest Airlines' Fred Robert E. Pease said the public must be sold on the concept before it can be used to penetrate the short-haul market. Midwest was forced to expand its experimental Sikorsky S-55. Eight hours' entertainment failed to induce the public to buy the service.

"We found that most passengers were absolutely afraid at the idea of looking a single engine, eight or 10 times a day at the heart of the country," Pease reported. "In the longer ones, we found that lead values and lead time have already effectively cut off almost my possibility of medium-haul operation on a short-haul basis."

Cost Reduction

Alschuler said total operating costs for a single-engine helicopter in 1955 should average not more than \$8,000 per available seat-mile of stage lengths of less than 200 miles (50 STM direct and 50 STM indirect). The company with an average of \$8,000/STM for permit maximum fueling, fixed-wing transports 100 STM direct and 50 STM indirect.

The right's economic edge over present aircraft would lie in its lower level of indirect operating costs, excluding passenger service, the ATA official said.

"The low-flying helicopter ratio is an excellent device for long haul and intermediate traffic but best of all is its economy to a passenger who flies economy, travel last 24 minutes per day," he said.

"As a replacement at some high practical and possibly to object sites, we believe in the fix of traffic. The high unmeted volume of overseas passengers who travel less than 100 miles do not fit a reasonably stable pattern of distance (time of arrival) and form of destination," he said.

Point-blank range problems preclude the Sikorsky S-55 and P&W T53.

St. Louis, will have an estimated direct operating cost of between \$8,050 and \$8,070 per available seat-mile of stage-length stages from 50 to 100 miles. This compares with the modern fixed-wing average of \$8,012 per 50 miles and \$8,038 per 125 miles.

He predicted a "calculated average" of 100% of revenues that would cost direct operating costs of copier transports to \$6,040 in 1960 and \$8,060 in 1965.

Alschuler said helicopter fares on short-haul routes should follow a similar trend, ranging between \$5 and 10 cents per mile at first and dropping to 6 to 7 cents when airfares begin, starting capture in first strength.

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SAE Observer

McDonnell's XF-88 tested for Althen's T-38 turboprop has reached Mach 1 in full power, static, dive.

Republic's XF-84 turboprop test vehicle is undergoing ground and prop vibration tests at Edwards AFB. Powerplant is Allison T-38. Now a supersonic propeller research vehicle, development could lead to an all-propeller fighter and fighter-bomber.

Darted-in engine with design rating of about 11,000 lb was the size of Packard Motor Corp.'s jet engine division; in fact back in 1946 Project was canceled in 1946.

Thrust-weight ratios of 10/1 are believed attainable in future turboprop engines for supersonic aircraft.

North American's F-86F modified with prism leading edge was first jet fighter to fly with boundary-layer control in the country. Maiden flight was May 18, 1953.

Convair XC-121D with canted boundary-layer control system flew Dec. 7, 1954 at Stinson Aircraft Co., now in flight evaluation at Wright Air Development Center.

New French system of boundary-layer control is step closer to operational application of aircrane and cargo. All engine exhaust is blown out of wing trailing edge for propulsive and boundary-layer control.

Drag chute does twice as much good as brakes on shorted tailfin 10 ft. end-to-end critical speed. Boeing B-57 drag factor is 30,000 lb at 160 mph.

Virtual factor in Miltex's optimum estimate is the construction of major heliports located in sites that would be as convenient as possible, reduced delays and low transition costs. The Air Transport Association's official government study of helicopter traffic shows that 10% of total flight time is spent in landing and takeoff, and 10% in hovering, says the ATA official.

"The hovering reservation ratio is an excellent device for long haul and intermediate traffic but best of all is its economy to a passenger who flies economy, travel last 24 minutes per day," he said.

Accessory Problem

The most perplexing problem facing powerplant engineers who have driven a new tailfin engine is establishing parameters for auxiliary power loads. New Bureau of Aeronautics says, however, that the Aercomac Power Source seems to be adequate.

Anomalous resonance occurs on the engine, as the engineers prefer, by total surface excitation because it is easiest and simplest.

But powerplant engineers seem inclined merely to load, mechanically, drive accessories because installation feasibility prevents more extensive consideration without changing engine configuration.

High-speed electric auxiliary engine loadings, starting 4 hours behind driving accessories from a single power plant, because there will not be room for adding more drives.

The USAF interest in acoustic resonance down-powerplants is to minimize bleed air because engine change is simplified, major build-up is rapid, and one

engine configuration could fit many places, using lighter requirements—possibly when over Air Force bases are approached. Accessories can be checked out on the ground by another power supplier without having to run up the engine.

Multiple systems both electrical and hydraulic are suggested for fueling and cooling. Cessna's new engine equipment with modulating elements on the 240 KVA power plant, engine, engine, or not, will depend on frequency held to run at rev. tolerance. So also not provide separate pump supply to feed each the species conversion current suggested in magazine? That would allow the even acc. supply which may be required to prevent current in the 240 KVA power source from being controlled.

Hydraulically, it is proposed to split air to drive leading-edge operation, flap, speed-brakes from the dual power control motor used to fly the aircraft. This will require a third hydrolic pump pad on the interests done.

Another electrical trend is towards an alternative current system with no dc generation at all. Small direct current requirements will be handled by a small motor that will power the frame.

Wind air is becoming too hot to handle. This is further complicated by the fact that modern turbines and turbines with air that can look engine intake and contaminate bleed air. Re placement would be a mechanically driven pressure pump and still another static pad.

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THE HIGH ARE THE MIGHTY

Altitude is power in aerial warfare. Leading U.S. jets

fly higher, nourished by Lear-Romeo fuel booster pumps.

These service-limited pumps deliver tons-per-hour

of vapor-free fuel, even at stratospheric altitudes
where fuel boils in the tanks. That's quite a trick.



LEAR
AIRCRAFT DIVISION 700,000

Air Transportation Will Advance Spectacularly, Says Fund Forecast

A continued high level of consumer spending for personal transportation is forecast as an economic study by the Worldwide Council found with expanded air passenger traffic in 1968 amounting to 100 million, over 1965.

Domestic air traffic for all classes in 1963 is estimated at 23 billion passenger-miles.

These three developments are viewed as the probable outstanding factors in the airline transportation picture for 1968.

■ **Airline travel growth as flight safety and dependability, technological advances and new operational techniques contribute to a tripling of air traffic volume between 1970 and 1980.**

■ **Moscow's aviations to the need for extensive capital investment in facilities for transportation.**

■ **Continued growth of private transportation through expansion of auto, airplane ownership and development of highway transportation.**

These estimates are made on the assumption that the economy will benefit from a major war or a depression, that populations will grow 10% and real national income will increase at least 30%.

Aviation Takes Lead—The Twentieth Century Fund report, "Aviation's Needs and Resources: A New Survey," brings up to date a survey made of the American economy that was originally started in 1947 and first published in its present form in 1948.

The most spectacular developments in transportation have occurred in aviation, the report says, "and in a manner which promises to exert the

greatest influence on the transportation system during the years ahead." Much interest, however, because of the helicopter and partly because of the opportunities it offers for meeting air traffic needs.

The program already made has been tremendous, but the possibilities now in sight through jet propulsion, radar power and the application of stored energy technology profit assessments, the report states.

Propeller Advantages—like the helicopter is also in the report as a key aviation development.

In great strategic importance lies in its ability to cut down on time required to land and take off at airports. Examples of the savings of many wing routes are given.

On a trip of around 200 miles a helicopter that is capable of 100 mph requires twice as long before it reaches station than an airplane traveling 170 mph. Flying ground base at each interval of 5 miles to the helicopter and 30 miles to the airplane, the helicopter averages 59.6 mph, and the airplane 65.3 mph.

Veterinological improvements in the helicopter are expected to extend its advantages for short trips over the airplane.

Conversely Potential—The report points out the rotary wing aircraft has a very advantageous flexibility. In the future, it will be capable of use between downtown and airport, between airport and airport, for metropolitan transportation and for intercity trips under 300 miles.

■ **Helicopter principles can be suc-**

cessfully applied to the airplane, the report predicts that in the conventional, they be the greatest potential for all weather navigation, speed and safety in the sea.

Principal deterrents to an accelerated start from now to 1968, according to the report, are cost and safety factors. These factors, especially because of the helicopter and partly because of the opportunities it offers for meeting air traffic needs.

Air Traffic in Gear—Development of helicopter and jet transport aircraft by 1960 is expected to improve the competitive position of airlines with respect to the industry.

Rail passenger traffic, but in recent years by comparison from air and logically based, is expected to decline from 27 billion passenger-miles in 1953 to 22 billion in 1968.

Total air traffic in 1960 is expected to reach 10 billion passenger-miles, 35 billion by 1970, 52 billion by 1980 and 85 billion by 1990. Total tonnage capacity will go from 65 billion in 1953 and 61 billion in 1955. Passengers will account for approximately 70% of this traffic.

Rising trends in foreign travel are expected to continue. Total air and bus services capacity is expected to go from 10 million passengers in 1953 to 4 million in 1968, with two-thirds of these seen existing passengers going by air.

Airport needs, including helipads, are estimated at \$100 million a year. The report says that introduction of jet transports may lessen stockpiling of terminals and that expansion of passenger and freight traffic will increase the need for buildings and other facilities.

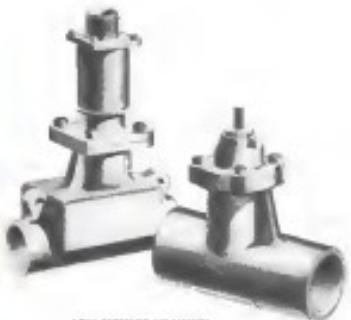


Avionic Test-Bed Gets T41 Turbines

Two Solar T41 gas turbines, drawn under the wing of a Convair C-131B, would supply electrical power to the avionic testbed Convair claims it will be the first externally mounted jet turbine source of extra electric power. Blasted in plates or metal pods, the possible units are designed for quick installation. The two

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Aveco Forms Air Weapons Team

A team of scientific consultants on nuclear energy, guided missiles and armament has been formed by Aveco Manufacturing Corp. to work on current research projects that include an anti-communist satellite missile and a part of the continental air defense program.

Strength of top scientific personnel in the fields required for new aerial weapons development and aerospace aerodynamics has been available to supply the broadest expertise on a consultant basis. This is the second group of scientific advisors assembled by the aircraft industry in the last month. Convair recruited an advisory team to assist in development of missile systems and aircraft and to study nuclear research problems (AW Mar. 21, p 16).

► **Important Personnel**—Victor Weisskopf, Aveco board chairman and president, and the summoning of the scientific group started more than a year ago when the company decided to participate in advanced scientific weapons programs.

Aveco's activities have extended to "important locations in atomic energy



Copter Target Tug

An electronic target, approximately 13 ft x 6 ft, a towed sled by a Royal Canadian Navy Harrier HU.5 helicopter. The target is floated in a cable unrolled from the sled's motorized sleds. The HU.5 is based on the assault version HMCS Shearwater,

and related fields, with our enlarged scientific staff at a fundamental part of present and forthcoming corporate operations."

► **Aeronomic Research**—Dr. Arthur R. Kornblow, professor of aeronautics engineering at Cornell University's Graduate School of Engineering, is continuing research in the field of hypersonic aerodynamics. In addition, he is an authority on the application of aerodynamic and atomic phenomena to high-speed supersonic flow.

► **Physical chemistry**, Dr. Simon H. Estate, professor of chemistry, Cornell University, former member of the staff of Standard Research and Development, and formerly with the Atomic Energy Commission.

► **Theoretical physics**, Dr. Max A. Berle, formerly chief of the Theoretical Physics Division of the Los Alamos Laboratory, who contributed to the development of the atomic and hydrogen bombs.

► **Theoretical physics and chemistry**, Dr. Peter J. W. Dohm, recipient of the Nobel Prize in chemistry for his significant contributions to the field of molecular structure.

► **Chemistry**, Dr. Clifford C. Parsons, director of the Technical Advanced Panel on Aeronautics, Defense Department, former Director of the Cornell Aeronautical Laboratory, and now chancellor of the University of Buffalo.

► **Mathematics**, Dr. Mack Kac, associate member of the Office of Scientific Research and Development and currently professor at Cornell University.

► **Radar**, Dr. John Rose, former assistant chief of the Antennas Laboratory, Air Force Cambridge Research Center, and now president, Radiation Engineering Laboratories.

► **Aeronautical engineering**, Dr. William R. Scott, member of the Naval Research Advisory Committee, and director of the Graduate School of Aeronautical Engineering at Cornell.

SEC Lists Aircraft Stock Transactions

Securities & Exchange Commission reports the following transactions of aviation stocks from Feb. 11 to May 30:

Aveco Manufacturing Co. Inc. Acquired 1,000 shares by the Royal Canadian Navy Association, Inc., holding 17,710.
Air Associates, Inc. Acquisition of 100 common shares by the Sixth Wings, Defense, making a total of 1,110. Received 41,416 shares of 4% convertible preferred stock from the Royal Canadian Navy Association, holding 10,000. Acquired 410 shares of 8% cumulative convertible pre-

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AERONAUTICAL ENGINEERING

Engineers Team With Doctors To Make Pilot's Job Easier

By David A. Anderson

All the information a pilot needs on his mission is presented by five indicators in a new instrumentation system developed by Hughes Aircraft Co., Culver City, Calif.

Two visual indicators show speed and altitude information, two circular scopes without separate altitude, direction, terrain, weather and collision warning data, the fifth presentation is a circular navigational aid with a moving engine marker plotted over a fixed chart of the mission area.

First showing of the new prototype highlight of the Aero Medical Ass'n's 36th annual meeting in Washington, D. C.—represented the first active participation of the aircraft industry in the association's biggest scientific meeting.

► Engineering and Medicine—The importance of aviation medicine to the health, design and welfare was further underscored by:

- Test-pilot's separate position, conducted by Eng. Capt. Donald McLogan, USAF (MC), and engineering consultants by Scott Crossfield, NASA; Maj. Arthur Murray and Lt. Col. Frank Everett, USAF; Robert Raka, Douglas Aircraft; Robert DeHaven, Hughes; Jim Rogers, Avco Aircraft, Canada. Common observation: Most personal gear is uncomfortable.

- Special sections on space medicine, outlining some of the problems of the next huge area of aircraft design.

- Equal presentation of medical and engineering papers presented during the meeting, with the idea of introducing doctors to engineering problems and engineers to medical aspects of flight.

Hughes Cockpit

Radar data and presentations are the heart of the Hughes instrumentation layout. They furnish steering signals, navigation plotting, altitude and some speed information.

Four of the five indicators—speed, altitude, steering and PPI presentation—are mounted in the conventional manner in a revised panel in the cockpit. The fifth—navigation aid—is on a flat console about where a pilot might place his chartbook.

► Speed Data—A vertical "Federal" indicator presents the speed information to the pilot. He sees against a graduated Mach number scale a radar indicator which reads the mission requirements. He has three ground control. He pushes the throttle to



FUTURE COCKPIT layout developed by Hughes Aircraft Co. emphasizes simpler presentation of information with less reference to printed air mission flight data.

match that indicator with a second under representing his actual flight performance.

A compass-card indicator shows the cardinal directions in a true azimuth reading during normal flight.

Approach and landing information is presented at the bottom of the sole. The left-hand side has a vertical strip colored green, yellow and red, with the green area at the top. At the plane goes through its landing path, an indicator moves down the scale indicating the proximity to stall.

The right-hand side has a scale of indicated speeds with a marker for the pilot to read during landing.

► Altitude Data—A similar presentation gives the pilot altitude information. A vertical scale of altitudes is at the center for a needle reader giving com-

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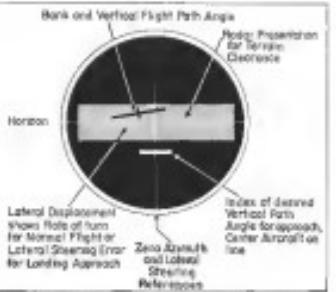
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DEFENSE AND INDUSTRIAL PRODUCTS



STEREOMIC information is presented by the scope in the Hughes completed panel. Attitude, terrain clearance, flight path angles and approach data are given.

more information from the ground, standard artificial horizon, the main pointer indicators, the Zero Reader, and the turn and slip indicators.

A scale indicator at the bottom of the indicator changes the altitude scale from a range of 0 to 60,000 ft. to a range of 0 to 10,000 ft.

A drama counter gives a direct indication of actual altitude to the nearest 100 ft. much.

A third reader on the side panel is, in effect, rate of climb information. It indicates the altitude that the airplane will reach one minute from the time it is read.

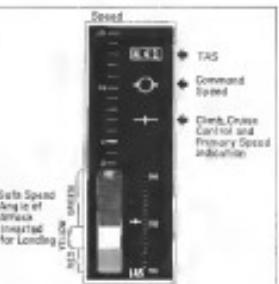
A hypermetric screen at the bottom moves with the terrain distance information and gives the pilot a quick visual check of his height above the ground.

P-Wave. Altitude, steering and flight path information is presented on a single scope of about 6-in. dia. It has a 10,000-ft. range and a 100-ft. resolution. A space-established center-Green polar presentation occupies a central horizontal band. Superimposed on the band is a cross marker representing the airplane.

From the position and attitude of the cross marker, the pilot reads bank and vertical path angles. Its displacement from the centerline gives him his flight path angle, the rate of rise for normal flight or by lateral steering error during a landing approach with no instrument system.

Superimposed on the face of the scope is a short horizontal bar, in dashes that is matched by the square markers displayed on the scope. It is read by calibration from the pulsed radar controlling the flight path, and is an index of the desired vertical path angle for approach.

This single presentation replaces the



SLIDERULE indicates gives speed information (above) and info desired for infinite presettment. Command speed is set by ground control or switch.

efficiency because of the equipment he is given. These are some of the other comments:

► On climbing: "The pilot was enough climbing to open a warplane store. I just don't want to get down and take the T-3 (partial-pressure seat) off and have to pack the thing up."

► On landing:

"The pilot was enough climbing to open a warplane store. I just don't want to get down and take the T-3 (partial-pressure seat) off and have to pack the thing up." I can't imagine the first time in the T-3 that you can't land it with the E-1 or with the M-4 (conversion only)."

► On operations: "Safety lights and banners are just weighed on cockpit."

► ALTA oxygen mask is critical on day, but it may be on the way out. "It's hard to get rid of your mask and after bailout."

► On training: "Pilot comments are not fed back into training soon enough. Armed泅水 information is up-to-date, but escape indoctrination is generally below the line. Comments are excellent, but nothing can simulate high-speed flight like the ground."

► On flight problems: "There's no good way to help a pilot as he comes along as long as he could be useful. . . . You can tell a pilot's age by noticing whether he cups his ears with one hand or two. . . . For high altitude flight, we take the canopy out of the Bell X-1 to get a little water vapor in the cockpit from our breath. That gives a little diffusion of light in the cockpit and reduces the extreme contrast. We've never gone over the experiments for half an hour before flying above 40,000 ft. Anybody who's going to fly over 50,000 ft. won't use the T-3."

Space Flight

Limits of flight in the upper border

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of the atmosphere were detailed by Dr. Walter R. Dornbeam, missile consultant to Bell Aircraft Corp.

Dornbeam's paper was one of eight devoted to the problems of flight in space and was one of the progress made in understanding them. These new publications are being used, and Dornbeam has five short papers on atmospheric:

- **Ground Light**—a portable space ship cabin, equipped with tools and materials for creating and maintaining the one atmosphere, has been developed for the USAF School of Aviation Medicine. Dr. Hubertus Strughold said that the kind of a cabin . . . gives us the space light in space."

Two problems will come under study in the school's use of the cabin:

- Extent and duration of climatic changes by the presence of a crew in the cabin, considering these changes by physical, technical or biological means
- Classification of noise in the problems encountered in such a closed ecological system, and the possibility of causing serious disturbance

The known causes of noise reduction in free space are known. In the atmosphere in the form of high-altitude balloon and satellite flights made with high frequency, however, urban and industrial noise.

Most interesting study: The issue has been getting grayhanded in a small of exposure.

Other checks on noise, on vision (darkening) and on variations of genetic material—were studied. None of the results indicated that radiation has any effect that cannot be explained in the basis of current data.

Technical Papers

The basic criterion for the efficiency of a man-aircraft combination (in other words, a possible mission control) was defined by A. M. Mirz, one of the strongest authorities in human factors in engineering design in this country.

Mirz, who is chief engineer and manager for Douglas Aircraft's El Segundo Division, defined the overall efficiency as a product of the smooth efficiency and the pilot efficiency. If either factor is low, then the overall efficiency of the combination is low.

► **Other Considerations**—This last subject has not frequently been overlooked in the design stages of future aircraft weapon systems, and it can help to explain the predilection of scientists with great high-performance planes. Still more:

"There are strong indications that man's limited brain capacity and strength per se does not affect with the speed and force necessary to overcome combinations of a type that he might have relatively easily handled in



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VTO EJECTION seats are made with a contoured subergonomics design. New ejection seats for the canard aircraft is completely automatic. Seat belt option is not optional; cushion load relief and automatically to prevent separation of pilot from seat. Ejectable pack is spread at speeds of 200 ft. at sea level, less than the plane is going forward.

been performance, assault. Additional explain on the design of ergonomicized seats for the pilot may reduce those sensations. Such systems might also increase overall effectiveness at a higher rate per unit expenditure than some of the more expensive aerodynamic and mechanical approaches.

Moss and the Navy's long range instrument development program was pointed toward a system available in 1958. In the meantime, interim modifications were being made.

Another plug for the Navy's progress came from Lt Col George W. Bowers, head of the Office of Naval Research. He has long been known for his experiments and theories concerning the pilot, and for his efforts in instrumentation development programs.

He pointed out that standardization of ejection seats was not yet possible. "Instrumentation has traditionally been developed from experience with clocks and strain gauges, and there won't be standardization until the environments are adequate to be analyzed," he said.

Bowers said instrumentation engineers had been so busy working off on "in drifts" that they never had a chance to sit down and study for prevention.

► **Short-Range Impressionism**—Inertial developments in the Navy's program have produced a new type of flight instrument, the short-range inertial reference system, inertial, lighting and guidance.

These never develop, and Navy air captain Fred R. Brown and William L. Lovvold, prov. the pilot safety and were remote performance with longer time spans upon his departure.

A new directional compass is centered on the aircraft panel, and gives the pilot aircraft attitude and direction information. Other indicators have been reduced to one. Five instruments are completely new. Angle-of-attack device, the computer pointer, altimeter, indicating the altitude in thousand feet. Mach indicator and digital readout, and a short-range inertial system with a single scale range in 20,000 ft. It's distance measuring indicator, a dead reckoning device giving navigational data and dependent on external radio signals.

► **VTO Boeing Ono-Geffen** out at a makeshift VTO aircraft from a series of different problems, with the most critical occurring during the landing phase with the plane nearly vertical. Conventional friction seat and manually operated seats would separate about 300 ft. of altitude to guarantee reliable operation.

So the Navy has designed, tested and installed a completely automatic ejection sequence for the Lockheed XPT-1 and Convair XPT-1. When the seat is ejected, the safety belt opens automatically. The seat is sealed immediately to separate the pilot from the

seat. The parachute pack is spread by a static line.

If the pilot ejects at 200 ft. or higher, he'll make it to the ground with an inflated chute, even if the VTO aircraft has zero forward speed. If he has some forward speed, the maximum safe altitude decreases, until at 200 knots he can open it low at 25 ft. off the ground.

Cdr Roland A. Beyer and W. C. Becker, of the Navy's Parachute Unit at El Centro, Calif., conducted five tests on VTO ejection by pointing out that this method of test and pilot separation seems to be a way to reduce ejection seat malfunctions, and should be considered in any single seat aircraft.

► **Deceleration**—No further comment qualified to talk on the effects of deceleration and overshoot on humans than Lt Col John T. Sturge, chief of the USAF Aero Medical Field Lab.

Sturge has lobbied for 10 years and again is proposing tenth round of code-breaking and solving the problem of high-speed escape. His article presents aerobic language and environmental parameters of the instant death along the high-speed tracks till the story before this any complicating could!

This is his description of one such test with deceleration goals of 15 and 40G, and an acceleration (and rate of change of acceleration) of about 600G, per second.

An hour and 10 minutes test was conducted involving the breaking of all human components and setting the human limits. Seats were pulled constantly tight. The chest area was deformed in the last 30 minutes of the time, and was pulled tight enough to restrain all motion in the torso. "The subject was held in a fixed position, and everything from their lower until the chest belt was removed at the end of the run."

The subject would take an about half a breath and holding it from the instant class of four until the end of the run, at a rate of about 12 breaths. Then after the test, the subject was allowed to move around, which he claimed the impression of speed, the acceleration was substantially greater and the sense of the seat against the subject's back more violent than in the previous run. The minute the subject was allowed to move between the two trials he was able to make a blunted escape due to inability to hold and perhaps to elevation of the head and helmet.

At about the count of two, minor survival to the control fields only, and then the count of three, the subject would blackout. This was usually confirmed by the eyes with no discoloration or constriction or dilation at the point. At the instant of loss of eye, the pressure of acceleration against the back instantly disappeared, an alarm was sounded and the wind died and all Helios effects discontinued at the point of loss of consciousness.

► **Deceleration Proof**—The notion that the forces involved, and human pressure could be felt on stoppage areas, there was a very rapid transition from black to silver in visual perception, followed by a brief view of the track and water tanks,



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surrounding Mr. Kershner's face. Below came into the window broken glass from the aircraft's body violently forced against the harness. Up to this point there had been a regular acceleration of word passes from left to a fanning of the shoulder of the controls, but no indication of explosive vibration. But as the aircraft continued to roll, the harness suddenly felt compressed and tension was felt around the arms, as though they were being dragged out of the socket. Voices became a thundering silence colored by the roar of engines, as though the people were strapped against the instrument panel. And the harness tension was felt in tight, strong, tight corners through the ribs.

The compression and pins increased steadily during the exposure to more than 29G as the aircraft turned. The pins felt smoother like the surfaces of a cushion or a cushion without feathers. The pins were unable to override resistance caused by compression over harsh steps, even though fine abrasions and scratches were visible at all stress points now.

When the pins stopped the usual appearance of disengaged velour was evident only because last was seen when the pins were first fired open. There was a marked magnification (approximately 10 times) of the resulting shock wave. It was difficult to open the pins even without some assistance. The shock wave was so tight that it was extremely difficult to handle. A sound cushion immediately lost that of struggling against the rigid of scratches was present.

After the pins had been removed and the test harness had been reassembled, the pins were as far as possible and the confusion disappeared. There was no loss of consciousness at any time. A pair of cotton apparently spent strips of insulation on it was inserted into the harness, but the metal passage was blocked and there was no further damage. An oxygen mask was placed on the subject's face, but was rejected with the remark that it intruded him up and got the straps loose. The subject claimed that he was able to move around in his seat of these P-47s. When the harness was again fastened the subject stated that he could not sit up to get off the seat, and was picked up by attendants and put on a stretcher. Then the complain of the pins reported, still firmly to prevent坐立 at 20G as in normal flight, and a half hour passed after the test.

Control room observed first, then people and by disconnected patches of ranges of the sky which gradually increased and increased until the subject was unable to respond with cold pads. This was an indication of onset or initiation of visual spasm such as had been experienced after a few minutes which was never terminated at 10G.

With the removal of the small pads and blocking of personal contact, however, and continued cooling from convection of the layers, and the heat loss resulting from deep sleep, there was only a feeling of relief and when at first the pins were cold, and of course that state was maintained.

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The same techniques used in the investment casting of Kinetomag surgical and dental implants in non-machinable metals is put to work for medical industry in Austenal's unique Microcast process. Complex precision parts, such as turbine blades and seats or the wheels pictured above by X-Ray are cast directly, eliminating costly machining and finishing operations.

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Thinner Wing to Raise X-1 Mach Limit

New, thinner wings, engineered and built by Stanley Aviation Corp., will replace the original panels of the Bell X-1 rocket-powered research vehicle. The new wings are 4% slacker, compared with 10% on the old.

The redesign of the planform surface is expected to extend the speed range of the research craft substantially above its present Mach 2.5 upper limit.

A set of panels is being installed in the X-1 at Edwards AFB, and the first flight with the new surface is scheduled for this summer. A second set has been delivered to NASA's (Laurel) field.

► The Pratt & Whitney engineers in their jet engine division Gordon Valentine once faced with a tragic design problem.

The maximum wing thickness was only 3% in the wing root. The wing had to take almost all of the loads of the original wing, although the available section depth was less than half the original value.

But the structural design wasn't the only problem. The Bell X-1 aircraft was not a statics, designed to get the maximum amount of flight information out of every aircraft that can in the air. So the team worked with test instrumentation and data reduction equipment.

The thin-wing problem led to having 343 folded-on plastic paper to measure structural strain and temperature. More than 200 pressure pickup surfaces had to be welded to the wing surface and connected to remote manometers by more than 3,000 ft of 5/32 OD aluminum tubing.

► The *Sabrelot*-Xer had to be legal in the name on the new wing panels, but Stanley engineers were able to get an aspect ratio revision. The value was reduced to four from the original figure of six.

The intent that the wing root section could fail in about 50% of the bending moment reported on the old wing panel, even though its actual thickness was less than half.

Primary consideration was given to aerodynamics in the design, the calculations at high Mach numbers and extremely thin wings. It generally is believed one is that any "vertical" stiffness was exercised by designing all points for minimum deflection so that there would be no "play" in the wings.

The final design is a multi-layer layout with tapered rolled skin attached via both lipped ribs and rib and span. Spans are of rectangular section and have no caps.

Maximum blade chord depth at the root is 2% in.

► Illustrated Note—Robert M. Stanley,



X-1 WINGS made by Stanley with multiple layers, with tapered rolled skin



TENSION TESTS of new wings strength. Aspect ratio is 4, down from previous 6



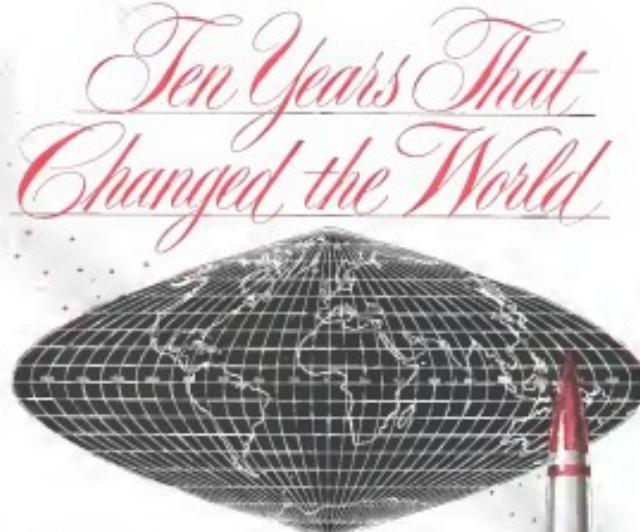
DEFLECTION OF WING under static test is indicated by horizontal dashed line (top)

president of Stanley Aviation, was Bell's sole consultant—registering for the major portion of the X-1 development.

In a presentation before the Institute of the Aeronautical Sciences in 1947, Stanley described the development of the XS-1, as it was called then, and referred to the "quite thin" wing

and the original method of skinning (tapered initial shape) used to cover the XS-1 jetliner.

Now, 10 years after the design concept that made the X-1, progress in the aeronautical arts has enabled Stanley's engineers and designers to surpass the aeronautical limits of the XS-1 design.



History records no more radical changes in the military sciences than those of the past decade. The period 1950-1960 not only saw the advent of nuclear weapons but, really important, new systems of defense and new means of offense—guided missiles.

Just ten short years ago guided missiles were only a visionary concept. Today they are the very backbone of our defense which now includes Weather, Civilian and the peace of the world will rise. Although largely assisted by the medicines of military science, tremendous strides are being made by all the branches of the U.S. Armed Forces in this crucial period.

The Fairchild Guided Missiles Division is proud to have a part in the missile program of our Armed Services. Starting in 1945 with the first of this country's true guided missiles—the Navy's surface-to-air "Loft"—the Fairchild Guided Missiles Division has been continuously engaged in designing, developing and producing missiles, radar and associated equipment. It has supplied missiles and missile weapons systems to the Navy, the Air Force and the Army.

In the years ahead, Fairchild can be counted upon to continue its role as one of the leaders in our missile program.



Left: 10 years of research in flight



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MIDWINTER, L. J.

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NACA Tests Lead to Flying Platforms

• Unusual one-man vehicles are payoff on 10-year research program; military services are interested.

Some research leading to smooth automated flying platforms has been carried on for nearly ten years by National Advisory Committee for Aeronautics and one of its leading engineers, Charles H. Zimmerman.

Zimmerman, a pioneer in the vertical aircraft field and designer of the unique Climax Vought FJ-2U, Navy carrier fighter known as the "flying pencil," holds a patent dated Mar. 25, 1947 for a "helicopter flying apparatus" that is fundamental to man-carrying flightless aircraft. It was filed by Helicorp Inc. (AW Apr. 13, p. 13) and is licensed (AW Apr. 4, p. 7).

Not long after getting the patent, Zimmerman joined NACA at Langley Research Center where the project was passed over and lost out, when a report was issued on experiments with a platform supported by a spinning rotor. ▶ **Simple**. Zimmerman, in cooperation with Paul R. Hill and T. L. Kennedy, Langley researchers, Zimmerman built and flew a platform supported by a jet stream of air. Probably the simplest hot air ring device since the late 1800's, it consisted of a small piece of plywood fitted with welded steel tubing as a heating



INDOOR FLIGHT. NSMF tested up to 35 minutes. To demonstrate stability, first shot down toe of tail cone with "booster" gas while several feet in air. Photo before silver幕幕.



NACA TEST VEHICLE has 70° nose and head off to support 500-lb. air jets at top disc rotor. Two other jets assist wings created by nose flaps.



SEQUENCE PHOTO shows model Rora by remote control. They can't afford lift-off because they can't shift weight to steer vehicle.

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Scientist Shortage

Read your article entitled, "Scientist Shortage Threatens Defense," in the Mar. 21 AVIATION WEEK [p. 11].

Very well written, but along with the hundreds of words article it is nothing but over of the problem and says little else. When I say very little else, I do not mean that, when facing down an administrator, one needs to know what to say to deliver new recruits to industry and government.

► Upfront: Strangely, they believe in the problem to be very important. The answer, I am afraid, is a resounding "No." Compared to Russia's method of producing new engineers which is one of positive induction, as against ours, based on induction alone, the present high school graduate system appears that we have an uphill struggle.

So in order to get more engineers to enter society to obtain an engineering degree we have to offer them an attractive environment. The biggest enhancement a scientist like you have to offer is a research center. Far from the wage and salaries we look for an engineering graduate. Relieve the charges and your expenses educational institution and also your supply of postdoctoral associates a necessity and you have the same situation in costing more.

This is not a theory of mine but a fact that I have had your through in 1970. Upon presenting in that year with a D. Arm. E. degree, the only position open was to experimental engineer and a few of the very top salaried students. I can remember one few months to employ as a type of scientific associate. The rest of the year I had to go to work in a research center. I had to leave at the time the Research center had no funds to create a shortage and put me in the market as an engineering field.

Let us take other facts, my supply of trained engineers and scientists being largely a voluntary stock could possibly fall and need to renew in a few years. This is if there are no improvements in the educational defense system. If disappeared, you would have engineers and scientists to teach.

► Shortage Solution—Getting away from that might happen and considering the problem in its true today, the problem has created two solutions.

Firstly it is that, through a demonstrative program, to increase both engineering, high school students to enter the scientific and engineering field. Aviation Week has voiced the load and clear, to have other publications.

The shortage in industry and government can be wiped out by working your present force to their most efficient capacity with the greatest efficiency and economy. This responsibility lies with the three areas on the engineering and management bureaus. Sufficient steps does not enter to get out and recruit from other areas and find the piping place at that.

Outside of this, which is based on observation of present and past practice in other firm and industry, the storage of engineers

and scientists will ensure, and a choice type for discussion at that, also.

MICHAEL OMAR
Design Engineer
5155 Raymond Way
San Diego 1, Calif.

[Aviation Week thanks Michael Omar for his comments. The article not only stated the problem, but tried to show what is and can be done to solve it. It is unfortunate that it took the Russian method and the constant threat of war to stimulate and encourage our shortage, but all indications are that we still continue to live in an "age of peace." An issue here to note is that in this very safe type that induces the needs graduated engineers were very late before the Russian War. The working of the Law of Supply and Demand is true, not only of an economy, but also of man's ability to meet the country's needs.]

You Mar. 21 issue includes an interesting article on the current over shortage of scientific manpower. The author of the article, a good one, states that the number of scientists has increased to several other working groups, based on a rate salary per scientist as compared to a 1940 salary index of 100.

It is interesting to note when government engineers fall on the graph, based upon similar data from a Civil Service Commission table, using 1959 as a comparison. The top government level of \$30,000 is 100% and the average engineering level 100%, while the average level of 270% compared to 100% for faculty members.

It is my opinion that Becker and other government agencies have had a good part of their engineering specialists to safety in the past 5 years. The tragic part is that even in safety, requiring in a technical sense below other professional groups at many levels. From 1 to 100, the very first government engineers to be very small is a government engineer using a pricing placement, whereas others have stayed to industry.

It is almost certain that engineering short ages will occur in the future, after all engineers above than soon as I will note, to the set of the engineering, science, unless they put that there will be no engineers above that for a high standard of living.

(NAME WITHHELD)
Evaluation Division
Bureau of Navigation

Approach Lights

Mr. Mader's letter in your Mar. 21 issue [p. 60] wherein he criticizes an airport's lighting is partially good. It should never properly be used in design at using the results of travel and laboratory test work and study tested and proved, and a sound and proven solution to a problem naturally disclosed on freedom and justified grounds.

If the decision had been made to the

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- Weight: 10.5 lbs.
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- Unit requires 115 VAC.
- Weight is 10.5 lbs. maximum.



MODEL E AP-2400 TYPE 201

- Dimensions: 10.5" H. x 10.5" W. x 2.5" D.
- Weight: 10.5 lbs.
- Current draw is 2.0 amperes maximum under normal operating conditions.
- Unit requires 115 VAC.
- Weight is 10.5 lbs. maximum.



MODEL E AP-2400 TYPE 200

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result of fuel consumption under test conditions and honest evaluation of the results, there should be no criticism. A decision based on opinion with no supporting facts, and supported by dishonest opinions and interpretation, is preposterous and this ought to end.

► **Nearly Unanimous.** A judicial committee of 12 representatives of DASA, CAR, USAR, and the Air Force ALPA in addition to aeronautical and technical authorities conducted five sets of test loadings in fog at the Landing Axis Experimental Station. At the end of the testing the committee recommended that the dephase approach lights be eliminated for the landing axis. None of the pilots who participated in the test force were in agreement with the committee's recommendation. The only dissenting voice was that of the ALPA member.

The ALPA, instead of suspending, brought a range of six different options to the committee. The first option was to allow the pilot to calculate the approach and to subtract its own perceived wind pattern.

The pilots who participated in the testing have made collectively more than 10,000 landings in the various ALPA member's configurations. The participating pilots received the most experienced and expert group of landing axis pilots in existence. Those endorsement of the dephase approach lights should have more weight than the vague references to the caption of "little pilots' preference" which did not even mention looking at thick fog and was allowed to make such language.

► **Facts.** ■ **Truth.** The following quotation is from letter I have received from one of those pilots:

"...and you bring up Eastern. Well, and I thought two might be interested to know that I will stick the dephase in the best interest of the lighting problem."

I know just how you've left where you have, and the stupid and biased inprints in the past, and no doubt there will be more to come.

► **Iteration.** Information on the approach is of paramount importance under all conditions and if only the pilots of today could gain enough information and experience on the dephase, and the radar altimeter, they then might bring about a change in a surprising half.

These are not influenced by natural pride. They are pilots who have sailed through it and who know from experience what they have to live for. The lighting is done fog and when approach patterns will give it to them.

We were means in failing to provide a calling job to the pilots, but the technical committee included an ALPA representative, and we were more than willing to believe that he would work with the aeronautical and technical forces. I believe that the result of the iteration will be informed enough to encourage the Landing Axis Experimental Station to go back to the both for themselves.

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How Marquardt Backs Up Ramjet Development Work

By Irving Stone

Von Neur, Calif.—Although engine development at the same activity at Marquardt Aircraft Co., the firm's work in assault and missile propulsion also includes afterburners, reverse thrust devices and high-temperature materials.

Some of the products which have earned Marquardt its 10 years in its present position as a leader in the missile field were described at Aviation Week last week (p. 45). The activities and facilities necessary to support this development effort are described in this article.

Accessories

The Accessories Division was activated about two years ago. Chief engineer is R. L. Goedecke. Originally, the division aimed at accessories and in association with rocket engines, but the work has gone beyond this function.

The development of accessory drives illustrates this trend.

- AD-1. First secondary drive developed at Marquardt, was for the Grumman F-11F missile. This drive was flight tested at approximately 10 to 15 Rpm range.

It was a 14,000-open-rpm disc-disk turbine hooked to a reduction gear box. It drove a 400-volt alternator and a hydraulic pump.

Designed to bolt to 30G launching acceleration, it weighed 11 lb., developed 40 hp at 4,000 rpm.

- This led in the AD-2 auxiliary-hubless carrousel with a 20-in. shaft built for Air Force evaluation.

The hubless was a direct disk solid driving at alternators, was designed to handle temperatures up to 918°F. For 14 lb. of weight, 95 hp was obtained.

- AD-3, the fluid accessories drive de refrigerant, was for missile service. This was supposed to have 16 hr. life but had to be ground tested for launch, then was driven from a hydrogen peroxide generator during the launch by the missile attained sufficient speed for the alternators to take over. A compensated shunting and governing device was involved.

The high steam temperatures created a turbine blade problem. Alternative steam power was 75 hp., weight was

70 lb. Reduction gear box was used to reduce the 30,000 rpm turbine speed.

- AD-4, was the next development. This combined the AD-3 gear box and the AD-1 turbine and throttle.

Staged for use as a power source for a guided missile, the unit was designed for a maximum life of 10 hr., was rated at 50 hp at altitude, weighed 57 lb.

It could be operated on pure air, compressed air, or nitrogen.

- Missile Fuel Pump—Marquardt found that development of a fuel pump was a necessity for its rocket work. For jet-engine missile service, it developed the air turbine-driven fuel pump, Model 7P1A. Temperature operational limit is 918°F. Vacuum weight is 11.5 lb., gross weight is 54 lb.

Pump is a single stage centrifugal flow and is featuring a unique safety feature. After the pump is started, it runs and can run at discharge until the turbine is still driven by one rpm. The pump is capable of disengaging to fail so that it will not be forced against its cover housing, thus protecting the air turbine from running iron and disengaging.

The turbine also may be operated on compressed air or nitrogen.

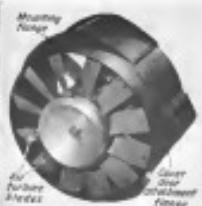
Rated speed is 27,000 rpm. Rated pump flow is 120 gpm.

- Emergency Power Pack—All this led to the present development of emergency power pack packages. In this type of unit, a trigger pushes the device out into the breeze and the air makes start-mating possible easily to drive the generator (Model AD-5), the unit is an alternator in which it drives a hydraulic pump to supply power for the flight control.

In another application (Model AD-6A), the motor-driven assembly has a pump for hydraulic servos and an a.c.-d. generator for electrical services. This unit is now used to fly in Navy fighters.

On another version of the AD-6 is turbine accessories. Marquardt is often given production status in connection with a fighter plane.

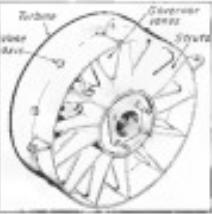
Speed of the AD-6A unit is controlled by a set of governor valves mounted behind the turbine wheel. The flyball



MODEL AD-3 emergency power pack consists of two air-driven turbines that drive pump to supply power for flight controls.



FRONT VIEW of AD-3 shows pump. Dog-grip piston device holds unit steady while unit rotates against emergency pump.



ANOTHER emergency power pack. Box new three-governor valves which choke air to turbine, and then regulate turbine speed.

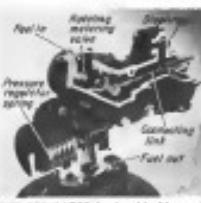
"Bogey at 6,000 miles!"

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FUEL REGULATOR designed by Marquardt for ramjet-powered missile. The regulator is only a part of the ramjet control system.

governor closes the valves to choke the air and in regulate the air turbine speed. ► **Bleed & Bleed-Kneen-Marquardt** is utilizing a bleed air turbine for secondary power, or subsystem and primary pilot burner, aircraft applications.

Another study is concerned with a bleed air turbine for aerospace applications. This would bleed air for relatively low gear conditions, thus contributing to compressor rest for high speed. The world famous **Bleed** was installed with bleeding air from a ram pump in Mach number increases. The quality for bleed air at M 3.5 is about twice that at M 0.6.

► **Ramjet Fuel Control**-important function of Marquardt's Aerospace Division has been developed had can truth for the company's ramjets.

Marquardt's engineers are that because of insufficient interest in the industry, to develop these controls, the company got into the picture itself.

The factors, until the ramjet control unique, Marquardt engineers say. These are fine tuned up to an inch in 100 miles, in a flow range of about 30 to 1, down to 150.

Marquardt has developed about 14 different basic models of ramjet con-



THE MACH SENSOR PROVIDES INTELLIGENCE to the regulators of the fuel regulators. The results are converted back to hold the flight Mach number steady.

Marquardt Ramjet Chronology

Timeline of Marquardt's work in the ramjet prototype, for various applications in aerospace and aerospace service. Here is a brief history of engines & concepts developed:

* **CIRCA 1948: MUSCHER 30-IN. RAMJET** is the development ancestor of this unit. Marquardt delivered it for flight test in December 1948. A later version with higher thrust, the C29 USC passed the Marine Navy KUM I Conger IV flight test first. In 1947, various models of the C26-H ramjet had been flight tested on the F4U, XF4U-1, P51, and F-82.

* **OTHER MARQUARDT RAMJETS** include the CM-10B, a 15-in-dia. unit designed to fly at speeds up to Mach 1; the CM-30E, a 48-in ramjet designed as an expendable nuclear cruise unit for interceptor aircraft; a 6-ft-dia. ramjet for passing the reentry of the Marquardt M-14 reentry, and a 7-ft-dia. ramjet rough, with stinger-type diffuser inlet, designed as an ranged type powerplant for the first stage of the Marquardt M-14.

Later, under a R&D contract, a development program was undertaken to improve the basic 20-in. engine's high-altitude performance and provide an altitude compensated thrust control, which could be set for various ramming speeds while in flight. This work resulted in the model CM-10C, delivered to the Navy in 1953.

* **FROM THIS EXTENSIVE BACKGROUND** come the impressive results which Marquardt has already developed and is working on for future applications.

One of the company's supreme results is proving Boeing's famous "Mile Mile" (AW Mar 23, p. 17).

Finally, the unique control flow features and parametric principles. Some of these units are servocontrolled, static duct-actuated. Diaphragm or bellows motion are used for sensing units. No diaphragms were desired for the environmental conditions involved, and in some cases, there was no demand power available so Marquardt turned to piezoelectric and bimetallic. Also, the philosophy, as far as keeping with Marquardt's principle of keeping the model self-sufficient.

The work in hydrodynamic-parametric fuel nozzle has led Marquardt to apply its know-how to the development of ramjet controls. One of these is a new ramjet control system for the **Scud**.

* **For New Fuchs-Baetz** development also will mean the perfection of controls for high subsonic gearbox and engine. Applications—This advanced design work is the next area Marquardt will move into.

While the engineer will make no comment, it is logical to believe that since Olin-Matheson Chemical Corp. is the holder of a substantial majority interest in Marquardt, that the two organizations will collaborate closely on the development of fuels for future ramjet engines.

Test Facilities

Several different types of Marquardt development engines are under test at the company's facilities, a CAFAC facility, which is a technical and test laboratory of the Navy. The lab covers approximately 8 acres and cost about \$1 million. Chief engineer of the Test



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Weight: 7% pounds
Dimensions: 6.5" diameter x 8.5" long.
Mounting Plane: Gyro axis referenced to mounting holes and mounting plane within 0.005".

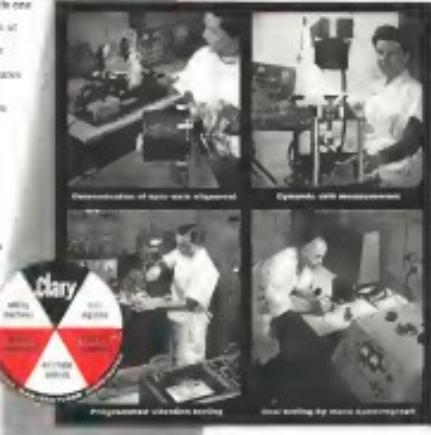
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• 10g, 100-2000 c.p.s.
• 10g, 200-2000 c.p.s.
• 10g, 2000-6000 c.p.s.

Pickoffs: 3 wire synchro, 1 pitch axis.

• Null voltage: 60 m.v. or less.
• Input voltage: 250 V., 400 c.p.s.; single phase.

Motor: Supply Voltage: 115 V., 400 c.p.s., 100% D.C.





How the country's largest exclusive producer of punches and dies changed complaints to contracts

...with Graph-Mo® steel

PORTER Precision Products, Cincinnati, Ohio, is the country's largest exclusive manufacturer of punches and dies—57,000 different sizes in stock. Formerly, Porter produced these products from water-hardening and other high-carbon steels, but found that such steels presented difficulties in heat treatment. When the cost of heat treating was relatively expensive and difficult to measure, and die life more erratic, demands for longer life

With a view to correcting these problems, Porter engineers selected Graph-Mo—one of four graphite tool steels developed by the Timken Company—a standard for the manufacture of punches and die sets. Because it contains fine graphite, Graph-Mo is easier to machine. And punches and dies made of Graph-Mo don't scoff at

gill. From every aspect, Porter's adoption of Graph-Mo has proved unusually successful.

Graph-Mo outperforms ordinary tool steels on an average of three to one. Millions of tiny particles of diamond-hard carbide—the size of the most wear-resistant carbides known—grain Graph-Mo and longer service life.

Graph-Mo may be the solution to your punch and die problems. For more information about all four graphite tool steels developed by the Timken Company—and their uses in dies, punches, pins, and machine parts, write for the new Timken Graphite Steel Dies Book. The Timken Roller Bearing Company, Steel and Tools Division, Canton 6, Ohio. Cable address: "TRIMCO".

TRADE SHOWS—EXHIBIT DIFFERENCES AND TEST EQUIPMENT

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STEEL

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ANGLE-OF-ATTACK TESTING is carried out in free jet facility. Angle of attack setting off (left) may be varied by means of movable inlet pipe (shown in foreground).

División de Leigh Down

Testing now is concerned almost entirely with supersonic aircraft flights at altitudes far above the capabilities of piloted aircraft. This of course, means supersonic missile development.

•**Labs at Capenhurst** only a Marquardt unit, working in test facilities at full scale, but as cannot requirements are well above the world's capabilities—more is needed at the present altitude levels.

The situation will become even critical with future aerospace requirements for engines which will be in the pressure zone. They could not be tested in full operating range with the present test setup. This condition generally applies to all supersonic developments in the U.S.

NACA facilities are also limited. Here, noise is the hindrance, because they must be shared with other contractors.

Arnold Engineering Development Center (AFDC) also is limited in the pressure zone.

Eventually it will be able to take care of all current pressure test of engines, but as far as going all endurance, sufficient time, there is no head to be expected here, nor Marquardt engineers say.

•**Quick Use** in the jet lab, as name goes, has been prepared for 24 hr to 48 hr per bottle for \$0.0005/lb or about 150 ps. This volume is expanded in less than 1 min. To have a complete plant to do the same job "hands off" would require an installation of about 12,000 sq ft to house extremely large quantities of air through the engine and from the test chamber.

Present operating time of the blow down is sufficient to give cold test results. Plans call for a decrease in pumping time to about 1 hr are underway. This would allow more frequent test runs. Intention also is to increase the exhaust capacity by 100% to house more flow under altitude conditions.

For low-altitude operation, blow down air only is used. At intermediate

altitudes (20,000 to 30,000 ft), blow down and exhaust are used. Above 30,000 ft, only the exhaust facilities are employed.

Marquardt Jet Laboratories includes

•**Shear load test**. This cell is used primarily for testing weapons under air load conditions. Hot gas from the nozzle exhaust is directed through a cooling water spray and a witness bearing being evaluated vehicles. Air and fuel flows, pressures, temperatures, stress, strain and forces are recorded automatically on oscillograph tape, charts and photographic film, for final analysis with high-speed computers.

High pressure air is supplied to the hot engine through solenoids, some or supercooled water. These are also changeable for creating desired air speeds.

•**Altitude test chamber**. As the name indicates, high altitude flight is simulated in this chamber with a circulation system which can pass two tons fuel/oil to drive the gas turbines of several other turbines. Consumption of the drives engines have about 12,000 lb of air to exhaust extremely large quantities of air through the engine and from the test chamber.

•**Compressed test**. This laboratory is used for special studies of gaseous and combustion problems and related parts. It also can be used for high altitude tests, such as gravity control, partial vacuum at the aft portion of the cell.

•**Model-scale air load test**. This cell is a larger facility for testing small scale aircraft and engine parts. Air moving through a small nozzle increases or decreases proportionately in



BATTERY OF AIR BOTTLES at Marquardt Jet Laboratories provides motive power for blowdown. Cooling tower is seen at rear.



TWO-DIMENSIONAL concept is mounted on the rotor arm at the whirling test facility.



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An address by R. P. Bauchem, Department Manager of Company Studies, on "Planning for the Best Aircraft" is available to interested persons. It shows the approach Operations Research takes to various problems. Address inquiries to Mr. Bauchem.

Operations Research experience is our necessity to join the department. A high degree of scientific ability and proven analytical tools are primary requirements. Those interested are invited to write E. W. De Lauter, Dept. O-3-4.

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EQUIPMENT

New Jets Get Ratio Thrust Indicators

By George L. Christian

Measurement of turbine temperature and rotor rpm is no longer a sufficiently accurate method of determining jet powerplant thrust. With new, bypassed turbines, where air compression may be occurring near stall condition without the pilot being aware of it, need for precise indication of thrust is especially necessary.

To meet this need, the ratio between total turbine exhaust pressure and total engine inlet pressure can be used. A series of pressure ratio indicators is now in production.

* **Kolloman Instrument Corp., Elkhart, N. Y.**, is producing a unit for USAF's supersonic McDonnell F-101A Voodoo fighter.

* **Armenius Div. of the Garrett Corp., Los Angeles**, is making a substrate for Air Force's jet interceptor, the Boeing F-102.

* **Minneapolis-Honeywell** is also making a pressure ratio indicator for the F-102 (AW Oct. 4, 2954, p. 68).

Kolloman is supplying other pressure ratio indicators to the National Advisory Committee for Aeronautics, General Electric, Curtiss-Wright and Convair. ► Why the Need?—Kolloman points out that since the transonic jet has two main operating modes, it must be able to change from one mode to the other without any appreciable rpm change.

Armenius says that very small variations in open and bypassed indication can result in large thrust variances—further, new engine power articu-

lation becomes necessary.

► What It Does.—The instrument uses one total exhaust turbine pressure and total engine inlet pressure and tells the pilot the ratio between the two pressures.

The pilot, knowing what the pressure ratio values should be, can immediately determine whether his engine is in gases as parting out the required power (as soon as he correctly sets the control for ambient temperature). Kolloman says also a manually selectable pressure ratio scale can be provided to allow the proper pressure ratio corrected for altitude.

With this instrument, the pilot can



HOW PRESSURE RATIO system for turboprop units is shown in Kolloman sketch. At turbine pressure discharge (1), exhaust, if total pressure exceeds (2), probe (3) is fed into pressure transmitter for levels (4) selected by pilot pressure dialektor (5). Measurement of pressure is transmitted by line (6) to long lever (6) of reading dial (7). Measurement of working shaft is transmitted (8) by gear train and is presented as dual as a ratio of two absolute pressures.

start in available in two positions.
► Digital reading. Hot turbine gases and air are fed past closely to the instrument in the cockpit.

► Remote reading. Since long plumbing lines to bring turbine gases into the cockpit are often undesirable, Kolloman has come up with a remote hydraulic indicating system where the basic pressure ratio measuring mechanism is located near the engine. Its measurement is automatically transmitted to the cockpit through a 400-psi electric servo system which can magnify amplification.

Both the Armentius Model 100 and Armentius Model 88-47 instruments are now available at Kolloman.

Giant Mobile Crane Lifts 40-Ton Plane

Can't move designed for Navy SEACAT can pick up and move planes weighing 40 tons. Friction is overcome using a motor coated dielectric liquid to prevent heat rise during lifting.

The crane's electric generator supplies emergency power for lighting runways, work areas at larger, the easier tasks. Designated MB-1, the equipment has a 32-kilowatt rating. If it runs 90 ft. long and more than 13 ft. wide, extended, boom reaches more than 30 feet.

Manufactured by LeTourneau-West Inc., Inc., Peoria, Ill.



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1955 — *	3520.16
1954	3440.29
1953	3248.07
1952	2541.95
1951	1680.92
1949	1526.22
1948	1342.77

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Fig. A1. 36-7 and E27-5 are standard models of Champion's new line of aircraft spark plug cylinder plugs.

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Brightly painted aluminum 20-in spheres fixed to high-tension lines on airport boundaries provide visual markers for pilots.

Initial manufacture has been made at Aids, Ohio, Airport. Spheres weigh four pounds and are made in halves that are fastened together over the wire. Recommended spacing is about 20 to 50 ft.

Muth Manufacturing Co., Canton, Ohio.

Cleandisks Clean Cloud Level

Clean cloud levels are sensed and transmitted to ground by a new instrument called the Cleandisk. The Cleandisks also can detect precipitation such as smoke and dust without professional lenses, the maker says.

The equipment can work with present meteorological equipment. It is claimed. Larson Laboratories Electronics Co., Division, 220 Dorcas Rd., Haverhill, Pa.



Counter Altimeter in Production

First units of a new precision counter altimeter have been delivered to U.S. Navy and a large number of the instruments are in production for Douglas Aircraft Co.

High accuracy is maintained throughout the instrument's range and a novel method of balancing acceleration force,

eliminating backlash and nonlinearity, holds down loss of accuracy due to high G-forces during maneuvering. The altimeter is temperature compensated in the range from -50 to 160°.

Sohmer Instrument Corp., 59-48 46th Ave., Elmhurst, N.Y.

Positive Light Flasher Weighs 1 lb.

Aircraft positive light flasher uses electro-explosive artwork, working through two cells to switch the light at 4000 cps rate. Unit weighs one pound and measures 3 in. x 2 in. x 1 in.

Unit meets or exceeds USAF MIL-E-7414, the manufacturer reports. Intensity is constant, operating at 28v to 36 volts dc. Life expectancy is 1000 cycles. Body noise filters are optional.

Electro-Specialty Co., 1406 Glendale Blvd., Los Angeles 38.



Plaster Nylon Makes Tiny Gears

Plaster nylon 1200, a new type of resin molding compound with aviation applications, has gone into large-scale production.

Aviation uses include wire and cable coating, where it offers high abrasion resistance. The compound's high tensile strength makes it a good material for use in mold cores for low-temperature decorative materials, the maker says.

Plaster nylon can be extruded with almost no voids in the finished product.

Brown Mfg., Allentown Chemical & Dye Corp., 49 Rock St., New York.

Tungsten Alloy Damps Vibration

High density tungsten alloy, almost twice as heavy as lead, is used as mass weights to dampen vibration in aircraft seats and gun sights. However, it can be machined to fit irregular shapes and used to balance and hold unbalance in the engine states. A note of the unusual points out that lead would be too bulky and would provide undesirable physical characteristics in seating units.

Colebrook Department, General Electric Co., Detroit.

Storage Battery Weighs 1.65 lb.

A tiny, almost rechargeable storage battery, approximately the size of a postage stamp, has numerous appli-

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McMurran was responsible, and in check sample of production raw materials in connection with the Titeflex Monitor Control Laboratory.

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extreme in extreme applications such as voltage references, noise pulsing, pulse controls, microvolts-threshold, referencing drivers and the like, the most important area.

Bristol-Myers units are going into a classified asbestos containment package. The vendor expects to have the small battery in mass production within the next few weeks.

The storage cell measures 400 in. in and weighs 4 lb. on. Capacity given at 4 amp hr. maximum discharge at about 1 amp. It can give peak pulse currents exceeding 2 amp. It is stated. Construction is galvanized steel battery is said to have long life.

Yankee Electric Corp., 49 Lessor St., New York 15.

ALSO ON THE MARKET

Prominently stamped legal blind copy packaging are claimed to provide legal protection against absorption and compression damage. Material is trademarked Corflex. —Sherman Paper Products Corp., Newton, Mass.

Portable seam welder works at rate 250 in. per minute, and over 180 deg. vertical and 160-deg. horizontal run. Progressive Welding Sales Co., 3670 Outer Drive, Detroit 34.

Surface flow of bonding material can be controlled to facilitate assembly by Newline Gumm Stop-DR, the manufacturer states.—Stainless Processing Division, Will Gummey Corp., 10145 10th St., Detroit, 2.

Oftosonic drill for shaping, grinding and polishing of hard and brittle materials provides surface finishes of 15 micro-inches. Using 120-watt ultrasonic energy of 0.003 m. it claims - latest information Electrosonic Corp., 81 Spring St., New York 12.



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even, which appears on all SAC plates, depicts Jesus through a model for having in stainless symbolic light a long history of destruction and an other birth. The white clouds and field of blue sky in the center symbolize the ideal conditions of SAC.

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Solar Energy Could Drive Spaceship's Electrostatic Powerplant, IRE Hears

By Philip J. Klass

An electrostatic powerplant fueled by the sun's energy may power spaceships. This is the view of Dr. Ernst Stuhlinger, a German rocket scientist who heads the small research section at Redstone Arsenal.

The spaceship would be as sleek beauty. It would carry a cluster of 40 or more logic-pumped reflectors for converting solar energy into electric power, giving it the appearance of a "large cosmic baton," according to Stuhlinger.

Being unable to develop sufficient power to get off the earth, the space ship would ride of from an earth orbit.

► IRE Symposium: Stuhlinger's notion of the possibilities of electrostatic propulsion was presented at an Institute of Radio Engineers' symposium on space station problems held during the recent annual convention in New York.

Other symposium papers reported on space station radio relay capable of providing over-ocean transmission of microwave and TV signals, and Massa, (Missouri Orbit Unmanned Satellite Earth) designed for atmosphere exploration.

The symposium chairman, J. Gordon Vaeth, predicted there would be "more" to the sky within than a few years.

Interplanetary Travel

Stuhlinger believes interplanetary journeys will be handled from an earth satellite and land on a single rocket engine riding around the final destination.

On this basis, the entire spaceship structure and its load of fuel will have to be transported to the mother satellite by convector rockets.

If conventional combustion rocket-engines are used to propel the outer protective spiraling, 175 lbs of fuel must be brought up for every pound of payload to be carried, Stuhlinger says. Thus the major portion of the cost of a trip to Mars would be the expense of transporting propellants from earth to the outer space.

► Electrostatic: Stuhlinger believes that the best, and perhaps only, way to reduce the cost of a mission of this type is to increase the amount of fuel to be converted into propellant exhaust velocity.

This is based on the ionospheric rocket theory for rocket vehicles.

Photo © (Robert T. Smith)
in Space (+) - Institut für Raumfahrt
König-Wusterhausen

Present rocket engines have thrust levels of 10 to 20 millisees, which may be near the practical limit for chemical fuels, Stuhlinger says. The extremely high temperatures involved in obtaining higher exhaust velocities far beyond the temperature limits of present engines would be prohibitive.

The ionizer, Stuhlinger suggests, is to accelerate propellant particles by means of a powerful electric field, one which he says has been advanced by others.

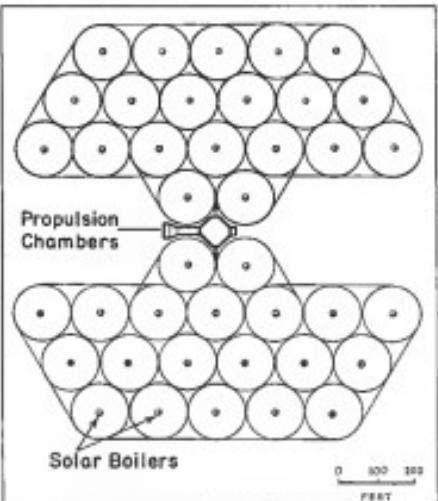
► Transonic Weight Savings: The total weight of an electrostatic propelled spaceship capable of carrying 10 tons payload plus 50 tons payload to Mars

would not only 250 tons, compared to 1,100 tons for a rocket-powered ship, Stuhlinger's figures indicate. Flight time would be approximately one year from earth-satellite to Mars-satellite.

Even more remarkable weight savings would result on a two year space flight, covering some 750 million mi. The electrostatic powered ship would start with a payload of only 20 tons, compared to 7,200 tons for one equipped with a rocket engine, Stuhlinger says.

► Fundamentals of Electric Propulsion: In the electrostatically propelled space ship which Stuhlinger described, charged basal fuels are atomized in form of materials such as carbon or aluminum.

When atoms of these materials strike an insulating platinum surface, they shed their ionized electrons (which



COSMIC BATON? might be set aside for electrostatically propelled spaceship. Microelectrodes that help convert solar energy to electrons give ship its shape.

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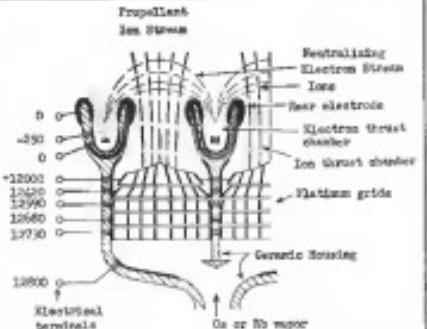
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PROPELLION CHAMBER of electrically propelled spaceship, shown in cross-section, has -250 v potential to accelerate and discharge propellant ion at extremely high velocity.

when the platinum leaving protons charged were

Re using a nearby heated stage, single charged electrons because the plasma density in the atmosphere the stream of current at relatively low can be accelerated and discharged to the atmosphere at extremely high velocities, creating propulsive forces on the space ship.

To prevent the spaceship from being using a negative charge allow electrons will off during the ionization process, electrons must also be expelled in the atmosphere. Added requirement is that the ions and electrons must be discharged simultaneously and at the same time, Stalling's says.

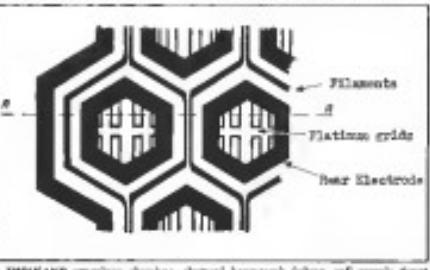
Space-Charge Effect-Used the charge on the discharged ions is too

reduced shortly after leaving the propellant chamber, the accumulated charge will tend to repel all ions even after they have discharged from the chamber, breaking the chain of ion discharge. This space charge effect is similar to that experienced within electron tubes.

The space charge problem can be overcome by combining the two charged stages and the electron thruster after the two are discharged.

Electric Power Needed—The product of ion current and the voltage required to accelerate and discharge the propellant ions from the propellant chamber requires power which must be provided within the propellant chamber's total capacity. Stalling's would require 7,000 to 8,000 W of electrical power for this purpose.

Stalling's expects 200-300



A THOUSAND propellant chamber, derived from the hexagonal lattice, will provide three

power sources, including an atomic energy pile, as long as fuel burns to generate this amount of power over a period of a year or more (required for space travel).

• Fuel Power Available-Solely, energy, however, is a source of fuel power available in outer space. An area of 1 sq m receives about 1 kw of solar energy. To put this to use, Stalling's proposes to use forty 50-hr dc-pulseable sources to concentrate the sun's rays so that is emitted at thermal power. Strained form in each solar boiler this power a small (200-kw) tube generator.

Each hydrogen atom, which is separated from the nucleus, is shielded from the sun's rays on a common arc with the leads. The entire solar package would rotate slowly around the emission axis, taking the condenser down to the edge where it would be paged back to the boiler (see sketch, p. 41).

The use of a large number of small solar generators, instead of fewer units of larger capacity, simplifies spaceship construction and makes it less vulnerable to serious power loss in the event a failure of a few units.

A power source employing thermoelectric couples or solar batteries, would be simple, but the temperature variation of the thermocouples, only 10% of that obtainable with radioisotopes, and a conduction loss implied in solar battery determine today's conclusion to use ion bombardment. By the time a spaceship such as Stalling's proposes is ready to be built, these factors may have been resolved.

To obtain the most efficient ion propulsion involves the optimization of many factors, Stalling says. These include choice of propellant, accelerating voltage, size of ion source and propellant chamber, and the optimum ion temperature level of the thruster.

For ion engines, large cathode potentials more efficient than operation, but increases the overall mass of the propellant and spaceship, reducing propulsive efficiency.

Propulsion Chambers—Stalling's spaceship would employ approximately 1,000 hexagonal-shaped propellant chambers, each measuring approximately 2 in. across. These would be clustered together in hexagonal fashion (see sketch, left).

Cathodes or cathodes would be for the individual propellant chamber each of which would contain a series of electrostatically heated grids of tungsten wire. A negative accelerating voltage of -250 v would be applied to a cathode near the vertical center of each chamber. Other cathodes surrounding the platinum grids would have high (12,000 v) positive potentials applied to shape and concentrate the ion streams to prevent

PRECISION SUBCARRIER DISCRIMINATOR

* FOR MULTIPLEXED FREQUENCY MODULATED INSTRUMENTATION SYSTEMS

Reference circuit from EMR's new Model 40 Precision Subcarrier Discriminator indicates that it will experience certain subcarrier discrimination used in frequency modulated television and data recording systems, and will establish new standards for systems now in design.

The new instrument, which is based on Radio Frequency Input Filter, Frequency Selective Amplifier, and an integrated circuit, provides a 100% linear first-pulse phase shift. Three outputs are provided, one of which will drive most pre-mixes in full deflection. Each discriminator contains its own electronically regulated power supply.

The Model 40 has a maximum input of 500 mV, a noise level of 0.1%, a conversion to -20dB, and frequency rate shift does not exceed 0.5% (all referred to full bandwidth). Wide range from the limiting of the reference oscillator amplitude, modulation effects and various mix ratios of input function characteristics, provides a wide range of applications.

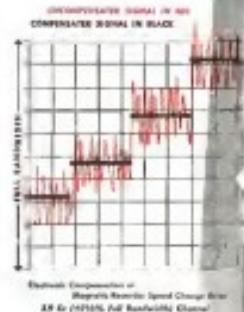
Of special interest is the fact that this discriminator provides constant damping of intelligence through a feedback channel, permitting reduction of recorded or transmitted multiplexed data, resulting at once, intelligence transmission of the maximum amount of information in minimum time.

Partial circuit, including detailed description of the basic circuit, is shown in the accompanying figure.

Electro-Mechanical Research, Inc., Ridgefield, Conn.

DISCERNING SIGNAL IN NOISE

COMPENSATOR SIGNAL IN NOISE



Time 0.2 to 1.2 sec at 20% of Carrier Frequency

Time 1.2 to 2.2 sec at 20% of Carrier Frequency

Time 2.2 to 3.2 sec at 20% of Carrier Frequency

Time 3.2 to 4.2 sec at 20% of Carrier Frequency

Time 4.2 to 5.2 sec at 20% of Carrier Frequency

Time 5.2 to 6.2 sec at 20% of Carrier Frequency

Time 6.2 to 7.2 sec at 20% of Carrier Frequency

Time 7.2 to 8.2 sec at 20% of Carrier Frequency

Time 8.2 to 9.2 sec at 20% of Carrier Frequency

Time 9.2 to 10.2 sec at 20% of Carrier Frequency

Time 10.2 to 11.2 sec at 20% of Carrier Frequency

Time 11.2 to 12.2 sec at 20% of Carrier Frequency

Time 12.2 to 13.2 sec at 20% of Carrier Frequency

Time 13.2 to 14.2 sec at 20% of Carrier Frequency

Time 14.2 to 15.2 sec at 20% of Carrier Frequency

Time 15.2 to 16.2 sec at 20% of Carrier Frequency

Time 16.2 to 17.2 sec at 20% of Carrier Frequency

Time 17.2 to 18.2 sec at 20% of Carrier Frequency

Time 18.2 to 19.2 sec at 20% of Carrier Frequency

Time 19.2 to 20.2 sec at 20% of Carrier Frequency

Time 20.2 to 21.2 sec at 20% of Carrier Frequency

Time 21.2 to 22.2 sec at 20% of Carrier Frequency

Time 22.2 to 23.2 sec at 20% of Carrier Frequency

Time 23.2 to 24.2 sec at 20% of Carrier Frequency

Time 24.2 to 25.2 sec at 20% of Carrier Frequency

Time 25.2 to 26.2 sec at 20% of Carrier Frequency

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Time 170.2 to 171.2 sec at 20% of Carrier Frequency

Time 171.2 to 172.2 sec at 20% of Carrier Frequency

Time 172.2 to 1

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Out of 9900 synchros recently supplied a customer for a single job, the rejection rate by his testing of some 20 characteristics was .0005% on each test. Nearly ½ of the rejections were on minute differences of calibration measurements.

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streaming the discharge optics of each chamber would be a fast filament discharging electron beam (such that an electron tube cathode) over the atmosphere to neutralize the charge of the ion stream. Neutralization would take place approximately 3 m behind the chamber's optics. Plasma temperature would be controlled automatically to produce the same number of electron and discharged particles per unit time.

Spacemar Laboratories-Nearcut of ions imposed by space charge effects and the ion current which can be achieved (350 amp), the automatically operated system which Spacemar designed would achieve accelerations of the order of only 1/10,000G.

This appears to limit the application

to interplanetary vehicles which start and end their flights in space where their weights are zero, Spacemar says.

Unlike rocket ships which must burn most of their range, the low thrust available from electrical propulsion requires one throughout the trip. During the first half of the trip, the thrust developed would be used to accelerate the space ship; during the last half, the ship would turn 180 degrees and employ its thrust for deceleration, Spacemar says.

Space Station Relay

A space station with 20,000 watts of power could successfully bounce TV signals across the sun, employing only a 50-km transmitter on the earth. This was one of several possible space station relays described by Dr. John R. Pierce, director of electronics research at Bell Telephone Labs (see also AW, Mar. 28, p. 35).

► **More Channels.** To maximize the economic value of such a relay station, Pierce said that a Multisat (two satellites) or a geostationary satellite could provide much more service than a single relay station could provide 30 hours in space.

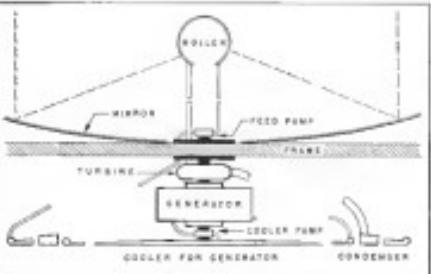
The several possible space station relays which Pierce described were based on the following operating concepts: earth-borne wavelength 40-mc RF bandwidth (employing single side band); 5-mic video bandwidth, pulse-coded modulation, employing an eight-bit code 20-mc RF signal to receive within 6-dB RF noise figure for the maximum receiver -10-dB received RF signal and 210-Bd bandwidth of earth transponders.

The orientation requirement placed on the satellite were equipped with a microsecond update rate to reorient and retransmit the earth signal if they were unable to track the earth.

These satellites, over 10-ft dia in cross section, would transmit a very low 15-milliwatt signal to the earth transversely. To do this, an adiabatic deviation of as much as 60° was, in an antenna 1 ft of which is 6.5° degrees could be tolerated, Pierce said.

► **For and Non-Sat.** If the satellite were a 1,000-Bd dia sphere made of suitable reflecting material, it could receive signals across the ocean if orbited at a distance of 27,000 mi from the earth, Pierce said.

By going to dual dipole arrays



SOLAR POWERPLANT for spacemar would employ parabolic mirror to focus sun's rays

At this distance, it would have the same period of rotation as the earth, effectively removing fixed reference to earth rotational points. However, at this distance an extremely high-speed rotation would be required to keep the station on the earth's geographic equator at the orbital strength at the outer terminal.

The power could be greatly reduced (to 100 kw) if the station orbited at 2,000 mi, but then it would have a shorter orbit period, causing it to pass to and from relative to the earth's normal stations. Thus several space relay would be needed to assure that any user was always within sight of the ground terminals.

► **Other Possibilities.** To get around these limitations, Pierce considered the possibility of a smaller satellite, 12,000 mi out, carrying a 100-kw or more user source.

This would permit each transmitter power to be cut to 50 kw, but impose orientation problems. The main target would be the sun, maintained at the proper orientation relative to the earth's orbit, within 1/20 degree, Pierce's calculations indicate. He suggested some sort of automatic servo control to tilt out my satellite orbit plane to cause sun and moon gravities to cancel.

The orientation requirement could be eased if the satellite were equipped with a microsecond update rate to reorient and retransmit the earth signal if they were unable to track the earth.

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The orientation requirement placed on the satellite were equipped with a microsecond update rate to reorient and retransmit the earth signal if they were unable to track the earth.

► **More Antennas.** Pierce would orbit the earth over 90 mi. Measurements made during an orbit would be stored in magnetic tape as does data collected down to earth in a quick burst when Minuteman passed over the receiving station, Staggs indicated. An FM/TDR telemetering system might be used, but there may be problems arising from Doppler frequency shifts due to satellite

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density and atmospheric refraction.
Sarge said:

"Electric power to operate Moon's electrostatic transmitter, and a small solar beam to permit tracking by earth-based radars, will come from the sun's rays, via solar batteries. (Supplementary storage batteries would be used to handle peak loads.)

In selecting an orbit which takes Man over both poles, the site of the satellite, containing the solar batteries, would always face the sun. Adjusting that orbital rotation determines the sun-conductance area used in solar batteries. Sarge said that this should not pose a serious problem because of the short duration of a single orbit.

His thought-built transmitter satellites of this type are capable of being used today and at a cost in line with current research spending (approximately chairman Vauth said, and may be in the six million to five years. Vauth is with the Navy's Special Devices Center.

He emphasized that the opinion is a personal one and does not necessarily reflect Navy's views, however.

New Avionic Diode Simplifies Design

A new silicon diode with extremely broad band characteristics has been developed by Schenck Electric for use in video switches, buffers, and communications equipment. It is designed for video detection and emission in the 1 to 12-kHz range.

Universal application in the avionics field reportedly presents considerable simplification in the associated crystal ladder or coaxial "T" mixer. The new type construction, called "Tupolev," provides three crystal connections instead of the usual two.

When used as a video detector, the IF signal is fed into a center conductor on one end of the crystal and the video output is taken off from a terminal on the other end. (The metal crystal shell forms the third terminal.)

When used as a mixer, the RF and



NEW TRIFOLAR ENGINE (right) makes possible compacted bodies (left).



Strut Assembly—
Wire Leveling Gear Retract



Valve Assembly—Steering Metering



Spool Valve



Prewirable Door Lock



Gear Box Assembly—
Outer Wing Flap Drive



Hydraulic Motor

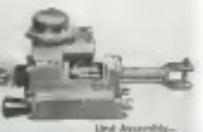
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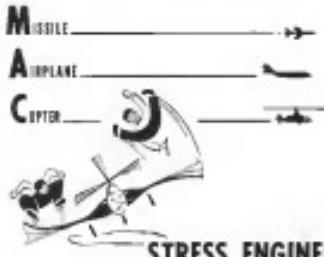
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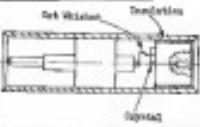
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TRIPOLAR DIODE construction details.

lead whisker pins are introduced at one end, completing the circuit to the metal disk while the resulting P junction is cut at the other end. The new Triplex construction makes the crystals essentially a semi-integrated shock-type device.

Sylvania presently is in pilot production on three types of Tripolar crystals suitable for video detector use, with newer crystals slated for production soon.

The three video crystals now available can be operated over a temperature range of -40 to 70°C, and reportedly have a maximum figure of merit (in an infrared broadband bolometer) of 10 or 15% less, a wavelength sensitivity of -40 dB over the frequency range. Characteristics of the individual types, at 25°C are:

- IN168: 3.124 μ sec., 4,500 ohms, uniform response, no heating at dc return.
- IN169: 3.124 μ sec., 15,000 ohms, no heating, built-in dc return.
- IN169A: 3.14 μ sec., 19,000 ohms, no heating, built-in dc return.

Application engineering data is available from Sylvania Electric Products, Electronics Div., Woburn, Mass.

Avionics Industry Reports Expansions

Holloman Electronics Corp., Los Angeles, has joined the acquisition fold of the aerospace division of Analytic Corp., leading computer manufacturers located in the same city.

By its transaction, Holloman acquires all rights to the Nordack mechanical differential analyzer which has been used by North American Aviation and several universities. Albert S. Cahn, former president of Analytic Corp., joins Holloman as a consultant. Holloman expects to move out its first production model within six months.

Other avionics industry expansions include:

• Mack Trucks, Inc., has acquired White Industries, Inc., and Radio Socie Corp., New York, whose interaction is the final major step in a long-range company development program. The two new addition will be come the Electronic Division of Mack Trucks. Key executive posts in the new division will be filled by Robert



Lightweight General Electric constant speed drives mounts directly to ADO Skyhook engine nacelle nacelle.

How G-E drive provides jet engine starting and a-c power from one engine pad

Having only one engine pad available for both jet engine starting and a-c power, Douglas Aircraft faced a difficult problem in the design of the ADO Skyhook. The feasibility of the General Electric 3 KVA hydraulically constant speed drive permitted the addition of starting gears with no performance penalty and only a small increase in weight.

Ideal for aircraft applications, the G-E constant speed drive features a bell piston design that provides

light weight and high reliability due to the small number of moving parts and simple mechanical operation. Drives can be supplied from 5 KVA to 80 KVA for most engine speed ranges.

FOR SPECIFIC INFORMATION on how the General Electric hydraulic constant speed drive can be tailored to your particular application, contact your nearest G-E Apparatus Sales Office.

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Schenectady, N.Y. 12301

Please send me these free bulletins:

GEA-A3914 404 Hydraulic Constant Speed Drive

GEE-D418 Theory of Operation of G-E Drive

For immediate product For reference only

Name: _____
Position: _____
Company: _____
City: _____ State: _____



New USAF-G.E. maintenance techniques give F-86D's 30% INCREASED AVAILABILITY

At Hamilton AFB, California, special jet engine maintenance crews cut 325th FIS operating costs, manpower requirements

The Air Force's 325th Fighter Interceptor Squadron now has a 95% higher North American Aviation F-86D "in command" rate and its maintenance costs and manpower needs have been reduced. These benefits are a direct result of entirely new 24/7 engine maintenance procedures initiated by personnel of the 325th and G.E. jet service engineers.

ONE USAF MAINTENANCE CREW, for example, now handles the squadron's 24/7 engine removal and replacement work. Previously, many F-86D crews were used for this job. But the new "special" crew—battalions reducing

maintenance requirements—have cut engine removal time to as low as 30 minutes!

A SPECIALIZED 7-MAN TURN-UP CREW also handles on-gate testing for all squadron aircraft after the F-86D's have been reconnected following inspection. Before, 20 men handled all squadron turn-ups.

Bevens reduced by the 325th are but another example of how G.E. jet service engineers are constantly cooperating with the Air Force. To G.E. jet representatives in the field—increased aircraft availability and reduced jet engine maintenance time are prime objectives.

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1. MAINTENANCE AIDS MAINTENANCE SYSTEM IN OPERATION. In this typical time economy, a G.E. JET is removed for routine checks. Inspectors inspect. Engine sent to test.



2. JET GATE TEST indicates a need for further checks at the control system. As G-E techs repair (below) instrument air electric engine distributor test.



3. JET GATE TEST indicates a need for further checks at the control system. As G-E techs repair (below) instrument air electric engine distributor test.



4. NEW GATE STRIKE, picked up at the Squadron's spare parts store, will be installed in complete engine after repair, ready 24/7 for reconnection.



5. PWR TESTING. A special servomechanism jury jury sends JET out to F-86D. By using a single crew for all JET repairs, the 325th Fighter Interceptor Squadron at Bevensen has reduced the number of personnel required for repairs by two-thirds.

HIGH PERFORMANCE PRESSURE SWITCHES

These recently developed aircraft pressure switches cover operating ports within the entire range of altitude of work through 35,000 ft. Corrosion-resistant materials are employable with operating media encountered in current and foreseeable aircraft applications. Design features permit all switches to meet or exceed the requirements of MIL-S-8752A and other applicable performance specifications. The three illustrated have application-specificities for specific applications—demonstrating the high performance standards of our complete line.

Our long experience and extensive facilities for developing, manufacturing and testing pressure systems for modern aircraft can be helpful to you. Engineering counsel is at your service. Please direct your inquiry to our headquarters plant, Danbury, Connecticut.



LOWE'S OPENING

Differential Pressure Switch, Type 6840
 DIFFERENTIAL AMMESTRY RANGE: 20 to 120 inches of water. INPUT
 DIA.: 1/2 INCHES. INTERNAL PRESSURE: 2000 psi.
 TEMPERATURE RANGE: -40° F. to +140° F. WORKING PRESSURE:
 1000 psi. WEIGHT: 10 POUNDS. DIMENSIONS: 12 INCHES HIGHT, 6 INCHES
 DIAMETER. Mounting: Center center of mounting hole, 6.500 INCHES. Per-
 mission: 1000 psi. APPROVALS: Wright 4-1700, 1000 psi. Length
 of cable: 10 FEET.



MEDICAL RECORDS AND INFORMATION

Pressure Actuated Switch, Type 6555

MEASURING RANGE: 0-100, 0-1000 psi. Adjustment or
SETTING DRAINS ALL VITON DOMEPIECE. 0-1000 psi setting 4% at
1000 psi. 2% at 500 psi. 1% at 250 psi. EXTERNAL ADJUSTMENT
FOR PRESSURE: 0-1000 psi setting 4% at 1000 psi. 1% at 500 psi.
0-250 psi setting 4% at 250 psi. 1% at 100 psi. 0-100 psi setting
0-100 psi. 1% at 100 psi. 0-50 psi setting 4% at 50 psi. 1% at 25 psi.
0-25 psi setting 4% at 25 psi. 1% at 12.5 psi. 0-12.5 psi setting
0-12.5 psi. 1% at 12.5 psi. 0-6.25 psi setting 4% at 6.25 psi. 1% at 3.125 psi.
0-3.125 psi setting 4% at 3.125 psi. 1% at 1.5625 psi. 0-1.5625 psi setting
0-1.5625 psi. 1% at 1.5625 psi. 0-0.78125 psi setting 4% at 0.78125 psi. 1% at 0.390625 psi.



韓國電影研究

Hydraulic Pressure Switch, Type 662R

PRESSURE ADJUSTMENT RANGE: 300 to 1000 psi. ADJUSTMENT IN SETTLEMENTS OF 100 AND 500 PSI. PLATE: 300 to 1000 psi. TEMPERATURE RANGE: -40° F. TO 150° F. DIAL: 300 TO 1000 PSI. FREQUENCY: 4000 Hz. WEIGHT: 1.5 lbs. OPERATING TEMP.: -40° F. TO 150° F. PRESSURE: 1000 psi. DIA. 2.5". LENGTH: 4.5". WEIGHT: 1.5 lbs.



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G. Koenig and G. E. Pray, former heads of the two agencies.

Electrolite Corp., Pasadena, Calif., maker of computers, will build a new \$10,000,000 plant in Pasadena to be located at 460 No Sierra Madre Villa. Slated for completion in August, plant will more than double firm's previous production facilities.

• Wurzburg-based Electronics division will build a 370,000-sq-ft plant adjacent to the company's Air Arm division at Framersheim Airport, Bremen. Full assembly and operation is expected by next January.

Topps Associates, Inc., has merged with Boston Market Works, Inc., under written agreement between B. F. Gitt, president of Boston, and Bill Kozlowski, president of the new merged operation, while H. J. Petrucci, former president of Topps, becomes executive vice-president.

• Dallas Avionics, Inc., Dallas, makes software and distributor of aircraft com

education equipment, has been pledged to membership in RVEA.

General Electric's Heavy Military Electronic Equipment Dept., will assist in the new \$9,000-a-kg. R addition to its Systems center, to house marketing and engineering activities. Occupations are expected by the end of this year.

FILTER CENTER

• Texas Is Happy—Texas Instruments, Inc., is now the nation's 11th largest

The world's largest producer of transistors, according to a spokesman, officially lists as the country's sole source of high-tensionshire silicon transistors in moderate quantities, a spokesman can hold for nearly a year but which assumptions may soon force it to release. Under Signed Corps sponsorship, TI is developing these new types of transistors.

Boeing Assumes Causality. Energy market of the recent national HIE show in New York around considerably seriously, because the company had no new equipment or products on display and had nothing to peddle except old items. Beldi set out not over a schematic or dimensional physical model of the energy source "was the slogan." Guided missiles as tough as electronic components," and "Vibration was one problem in missile electronics."

*Transistor Bibliography Available—
Transistor and Their Applications.*" A bibliography covering the period of
1948-53, is available gratis as long as
we supply it. Write to Technical
and Institute Library, Northwestern
University, Evanston, Ill.



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Bibliography p. 23-24. **B. H. Deininger** and
co-authors report a significant increase in species
richness in the *Grindelia* community.



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AVIATION CALENDAR

- Apr. 27—Missouri State Experiment Station, spring meeting, Hotel Statler, Los Angeles
- Apr. 28-30—National Helicopter Society, 7th annual, Town Hotel Marquette, Worcester, D. C.
- Apr. 29-30—Aerospace Association, Conference of Michigan Auto After Apr. 30-Institute of Navigation, annual regional meeting, Friendship Airport, Milwaukee
- Apr. 29-May 1—Raymond Laboratories meeting, sponsored by Boeing and Convair, Vicksburg section of IEEE, Sheraton Plaza Hotel, Boston
- Apr. 30-May 1—Force Avia, Rhône Wing convention, Sheraton Hotel, Chicago
- May 2-5—Society of Automotive Engineers Annual technical conference, Hilton Hotel Ft. Worth
- May 3—Electrostatic Society of America test method flight test instrumentation Symposium, Allis Blawd, Wichita
- May 4-6—Fourth International Aviation Show, 60th Regiment Armory, New York
- May 4-7—International Aircraft Maintenance & Repairers Memorial Conference Ft. Worth
- May 8-10—National Inter-Collegiate Flying Association, annual air-meet, Municipal Field Ft. Worth
- May 10—American Rocket Society, New York Section, meeting, Sheraton Hotel, Dover, N. J.
- May 14—Association of Northern College Flying Clubs, annual inter-collegiate competition, Ft. Lauderdale, Florida
- May 14-15—National Conference on Standardized Practices, Edgewater Hotel, Daytona Beach
- May 16—National Fire Protection Association, aviation section, Sheraton Hotel, Chicago
- May 16-20—Annual Memphis Hearing Exposition, organized by Clapp & Polak International Amplifiers Corporation
- May 18-19—Av. Navigation Development Board technical symposium on communications radar beams, Washington, D. C.
- May 19-20—National Telelectrical Conference, Missouri Hotel, Chicago
- May 21—Royal Astronomical Society, 4th William Whipple Memorial Lecture, Royal Observatory, London, Lecture by C. S. Draper, head of Department of Astronomical Engineering, Massachusetts Institute of Technology
- May 21-22—Armed Forces Communications and Electronics communication conference, Commodore Hotel, New York
- May 23—National Society for Quality Control, ninth annual conference, Hotel Statler and New Yorker, New York
- May 26-May 27—Rhine Boating Association championship regatta, Wethersfield, N. Y.
- May 28—Professional Aerostation International and NASA, Royal Netherlands Academy of Arts and Sciences, De Duyph, Scheveningen, The Hague, Holland
- May 30-June 4—Aviation Writers Assn., 1955 annual convention, King Edward Hotel, Toronto
- June 4—Regional Aviation Seminar, cost of civil Maintenance and Operations Meeting, Reading, Pa.

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Trend in Aircraft Earnings

Number of Companies	Reported net income after taxes (\$000)	Book Net Assets	Percent Return on Assets	Percent Return on Net Assets
1945	22	37,720	560.77%	1.6 2.8
1950	27	47,370	548.95%	5.3 9.2
1951	28	54,181	592.67%	4.8 10.3
1952	33	51,679	565.74%	2.2 5.2
1953	32	427,167	712.88%	2.8 27.9
1954	38	376,271	875.15%	2.8 26.8
1955	58	378,981	998.68%	3.8 27.4

* From industry and parts manufacturers.

SOURCE: National Can Bank Letters, National City Bank, New York.

Aircraft Profit Rise Best in U.S.

Aircraft industry earnings for 1954 were extremely good. They showed higher growth over 1953 than all other selected groups.

This accomplishment stands out in the annual increases put out by the largest National City Bank of New York (formerly National City Corp.) bank, a recognized source in measuring earnings and rates of profitability for all industry. For 1954, it covered 3,642 companies.

► Big Jump—The annual group—16 percent better—was quite remarkable—marked a new peak in net income after taxes. Net was \$272 million, up 34.5% over 1953. This is an impressive rise with the expansion pattern of the year the best last year (AW May 22, 1954, p. 53).

The gain was by far the best among industrial groups—all manufacturing enterprises (1,778) averaged a 4% increase in net income for 1954 over 1953—but percentage return on sales was only 1.8, compared with 3.0% for all manufacturing companies.

The slight gain in net income was largely due to the complete liquidation of the excess profits tax for most companies. Corporation on a fiscal year basis left RPT for a limited period during the year.

But it is important to note that for many years the aircraft industry has experienced a rate of even 10% annual return on its investment.

Aerospace earnings level that can be observed is that the aircraft industry has consistently maintained its capital expenditures that constantly augmenting its property account. In other words, the aircraft industry is becoming less dependent on subsidies obtained under government loan.

► Not Always High—The calculations show that the aircraft industry has not always been prosperous and only is

Another turboprop first by Aeroproduts!



NAVY R3Y TRADEWIND WITH AEROPRODUCTS TURBOPROPS COMPLETES RECORD HOP!

Convair eighty-ton cargo-transport, powered by Allison gas turbine engines and Aeroproduts turbopropellers, flies coast to coast in six hours for seaplane record

Aeroproduts turbopropellers made flight history again February 25 when they helped power the Navy's giant R3Y Tradewind on the first cross-country hop of a seaplane seaplane. The 80-ton Tradewind flew non-stop from San Diego, California, to Patuxent River, Maryland, in six hours. A cargo transport, the R3Y cuts the travel toward with use of turboprop engines and turbopropellers. This pioneering flight also marks another first for Aeroproduts. In 1948, an Aeroproduts turbopropeller was used on a Convair Field in the

first flight of a turboprop-powered plane in the United States. In fact, Aeroproduts turbopropellers have more flight time than any other American-made turbopropellers.

But turbopropellers are just a part of Aeroproduts' contribution to safer, more efficient flying. Aeroproduts is ready now to meet your specifications for other propellers, air-driven emergency generators, air-driven hydraulic pumps, actuators, other aircraft components still in the development stage. Call or write for details.

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CHULA VISTA AND SOUTHERN CALIFORNIA

Summer Air Traffic to Reach New High

Lack of equipment, crews limiting factors in boom; carriers expecting minimum 10% business increase.

By Craig Lewis

The summer—the big season in airline travel—will be the biggest the airlines have ever had.

Capacity will be increased about 10%, and the traffic will appear to be about the same as it is assumed that the current fuel losses will operate to 20% below the traffic potential just because there will not be enough airplanes and crews to handle the crowds on high density routes.

U.S. airlines are in the midst of a substantial boom in traffic that probably will result in a very much improved profit picture this year.

There are numerous unanswered questions involved in assessing the factors behind the boom and the prospects of its continuing. But most observers agree that the increased traffic and an increase in load factors is key to profits—“are going to solve last year’s problem of enormous profit margins.”

Predictions for a big summer are based on various appraisals. An accurate one is the phenomenal first quarter traffic that has taken, continuing the trend that started last fall (AW, Apr. 18, p. 12W). Even if the airlines merely retain gains already made in 1955, the year’s business would set records.

“More Migration”

Industry experts, wary because of some unexpected over-past winter factors, cannot be considered in making predictions. Again, that traffic will increase more than 10% in domestic and international travel. Total passenger forecasts are 16.5 billion domestic passenger-miles and 4.2 billion international passenger-miles.

Other signs are seen in industry expansion of services. Pan American World Airways has increased flight frequencies in trans-Pacific schedules by 51%, and Trans World Airlines has increased states capacity in trans-Pacific schedules by 11%. Both are mounting a “vacation migration of Americans to Europe,” a TWA official says. Both are sharply booked for the season.

New equipment will increase capacity. TWA will complete delivery on an order of 20 Super G Convair 880s by mid-June. Both Eastern Airlines and Pan American will add

them to the variety of establishment buying place for ticket purchases. Pan American alone expects to bring in about \$10 million in new business this year with its planes, and other carriers are equally optimistic.

The reasons for all this enthusiasm and off the gates early this year have developed clearly, mostly because the experts are still somewhat mixed up about it.

But the most popular game, and undoubtedly the closest to the truth, is that business is good. The concern is unanswerable good health and the airline industry is looking along with it.

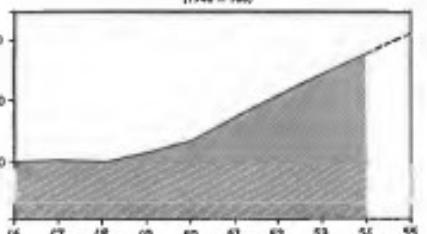
The national basis is taking place as both production and revenues break, and that is the key to the success of airlines.

It isn’t yet clear how much prompt first class equipment will be released for conversion to economy, but the bulk of these are going to advance which will increase passenger. Conversion is likely quickly and early, as it is difficult to spot figures very well in advance.

Spending Meets

Domestic Trunkline Traffic

(1948 = 100)



industry, consistently exceeded that of the gross national product. The trend and measure of the country's wealth seems to be up. But factors which contributed to this "sooty" relationship, sooner have become relatively less important as the growth rates in production bring them up to modern standards.

As the public comes more and more to regard air travel as just another form of transportation, there is likely to be for it a more than a modicum of value than their feelings about safety or reliability. The key to the airline profit situation lies in load factors, and they are one of the encouraging factors in the boom. There have been steady increases in load factors since 1951. The latest figures show last fall load factors have averaged nearly two points above last year (see box).

The airlines are selling a very perishable commodity. If a seat isn't sold on a flight, it disappears as a soluble mass. Some costs remain fairly rigid whether flights are operated full or empty, the percentage of seats sold, the load factor is highly important. Once the factor reaches a breaking point, which varies among carriers, revenue shows up with a high percentage of profit.

Last year, airlines were concerned over enormous profit margins. This year, revenue rates, profits didn't, and a need for fare increases was discussed.

Charter Review

Since traffic growth has been relatively constant over the years, the cause of fluctuating load factors has, to a large extent, been variations in total capacity. During 1954 the domestic airlines made considerable additions to their fleet. The increased capacity beyond necessities in traffic with a logical decline in load factor. The expanding part of the



Turboprop YC-121F Starts First Takeoff

First independently powered YC-121F built by Lockheed Aircraft Corp. starts to roll down the runway at Burbank on its maiden flight. The new Air Force transport now is going through initial flight test at Lockheed's Burbank and Palmdale facilities. After

the builder's test program is completed, the YC-121F will be flown to Edwards AFB for further tests and crew training. Powered by four Pratt & Whitney T38, the military version of Lockheed's Super Constellation will be a passenger-cargo-hospital plane.

Domestic Trunkline Load Factors

	1951	1952	1953
Jan.	63.2%	66.8%	61.6%
Feb.	64.3	58.7	60.6
March	66.3	59.3	
April	66.9	62.6	
May	61.8	64.5	
June	71.9	69.7	
July	68.4	66.1	
Aug.	66.4	73.9	
Sept.	68.3	68.6	
Oct.	61.9	63.3	
Nov.	59.1	64.0	
Dec.	59.4	61.6	

current upward trend is that traffic has taken up the slack in loadability as quickly. Encouraging thought is provided for future traffic in a certain extent, even notwithstanding the present needs.

Airline confidence in greater future traffic gains is shown by the huge backlog of orders from both U.S. and foreign carriers. Since the factor reaches a breaking point, which varies among carriers, revenue shows up with a high percentage of profit.

Last year, airlines were concerned over enormous profit margins. This year, revenue rates, profits didn't, and a need for fare increases was discussed.

The certified carrier loses encouragement in developing single line traffic and, conversely, has surface the equipment out the inclination to divert their energies to charter routes.

Meanwhile, exceptions applications from irregular carriers have increased to take up the slack left by the international flag carriers.

The CAB will hear arguments this week from interested parties and will decide whether a change is required.

CAB Proposes 1955 Airworthiness Agenda

Cab Airworthiness Board is circulating for industry comment a proposed agenda for the annual Airworthiness Review Meeting scheduled for next September.

The proposed agenda consists of 20 major areas, all suggested changes in the Civil Air Regulations.

CAB's Bureau of Safety Registration requests industry comment on the proposed agenda to be submitted by July 1. The comments will serve as a basis for preparation of a final agenda which CAB will submit Aug. 1. The final agenda can be submitted in writing no later than July 15. The agenda will be added to the substantive meeting.

A recent move taken by the Civil Aviation Board gives another indicator of the attention given international travel. The Board is going to review its trans Atlantic passenger charter policy to set it in strict charter charter under the current policy, Atlantic charter is supposed to be operated by the commercial carriers whenever possible.

On the basis of recent reports, the Board has recognized that while regular carriers have experienced considerably dramatic increases in traffic with a logical decline in load factor. The expanding part of the

airline's change in structural requirements, control surfaces and restraint designs, powerplant installations and instrument compartments, improved indicator markings, position light requirements, fatigue strength requirements, gate limit requirements, inertia seats and safety belts, and flight assistance panel arrangement.

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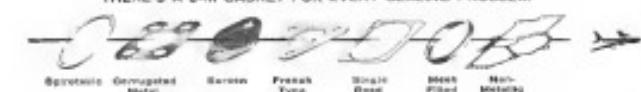
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PRODUCTS FOR THE
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EAL, Braniff Get Interchange In Settlement of Balboa Case

Pastoral Burkhardt and the Civil Aeronautics Board last week ruled in the Balboa case that Eastern Air Lines and Braniff Airways should operate an interchange service between New York and South America in order to protect competition among carriers serving Latin America.

The case had finally settled after years of protracted negotiations in which it had stalled back and forth between the CAB and the White House, reopened, delayed twice and now, finally, approved. In the process, though, were made to effect a merger between The American-Globe Airways and Braniff Airways, but they failed.

Provisions

The decisions approved by the President in August, G.O. 66, went to print nearly the same one which first went to the White House in June 1962.

It provides for:

- An interchange between Eastern and Braniff between New York and Balboa, C. G., via Managua and beyond to South America.
- Approval of the through-fight agreement between Pan American World Airways providing the two carriers reach an agreement for a New York-Balboa interchange with National Airlines.
- Proposals for interchanges between Eastern, Pan American and Pan American.

The basic question involved in the case was which combination of carriers should be approved for interchange service between the United States and South America, where Pan American and Braniff compete. A number of plans were presented involving National and Eastern between New York and Managua and Pan American, Pan American and Braniff between Managua and the South.

Latin America is the largest oceanic market for American flag carriers. Improvement of service between the Northeast and the South is regarded as important from the point of view of measurable service benefits to the public. The Board grants that the Eastern-Pan American plan is best.

CAB Ruling

The determining factor in the decision favoring Braniff and Eastern was the need for strong competition in southern routes. Both Braniff and National are small in comparison with

their competitor-Eastern and Pan American.

"It is clear," said the Board, "that the Eastern-Pan American-Pan American combination would have an overwhelming competitive advantage over all other American carriers in the South American area and in the United States. This advantage flows from a variety of factors including the vast disappearance in the combined's favor in the size of the competing carriers, their encroached position in the market, and the much larger sales, passengers and budgets available for promotion of their service."

The Board pointed out that one of

the reasons for reclassifying Braniff to South America was to provide competition for the Pan American system. It was found necessary to give Braniff access to the big New York market in order to promote more vigorous competition on the southern routes.

The proposed continuations give

ACC Adopts Tacan Compromise

A new navigation system concept for short range air navigation has been laid down by the Air Conditioning Committee.

The concept calls for a cost-effective, cost-tolerant system (VOR/DME), as well as a basic flight system (Tacon), with alternate subtypes of Tacon for use in the eventual consumer version. Under this proposal, ACC estimates, VOR will be eliminated until 1965 and that DME will be continued until 1966. The ACC division follows the congressional decision made by the Navigation and Development Board except that it agrees to seek reduction of DME until 1966. ANDB recommended ending DME this year.

The ACC report states: "The agency at the governmental responsible for the implementation or operation of our

Transport Report Favors Railroads

The long delayed and disputed report of the Cabinet Committee on Transportation was issued to the President last week in a much more altered form than originally written.

The report has little application to aviation. It is concerned for the most part with freight and is generally intended to be favorable to the railroads. The whole philosophy involved in that transportation regulation is based on a唱和的 situation which no longer exists. The committee recommends that regulation, especially of the railroads, be altered in other areas greater recognition afforded.

In order to become fully effective, the report will require implementing legislation. There is practically no chance of getting through Congress this late in the session, and passage next year may be difficult. The trucking industry doesn't like the report, and it is a powerful political issue.



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This small, easy-to-handle jet is designed to make the transition from prop-driven to jet-borne airplanes easy and safe.

Training Air Force cadet-pilots today calls for a light, maneuverable aircraft that permits an earlier transition into jet flying. The Air Force gave the responsibility for developing such an airplane to CESSNA.

A low landing speed has been designed into

the T-37 which also flies at high speeds when needed. Another feature is wide-track landing which affords better landing facilities. All of these developments add up to training in time and cost.

* * *

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The All American Light-weight Model 42 which is good for airframe heating and fuel oil or propane.



The laboratory at the base of the tower is used to test whether, with both hydro- and electrical power,

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phase in phases of the present or future decision system program will consult with other nominated agencies through ACC in the discharge of these responsibilities. Any implementation of DME will be carried out only in a manner consistent relationship to the other needed improvements in the system.

40.2. set out the major steps for the implementation and development of their districts as navigation systems

Airlines File Salaries, Bonuses Paid to Executives During 1954

Scheduled when governors to office and directors for salaries, bonuses and other compensation during 1994 were reported to the Civil Accounts Board as follows:

Wichita Falls, Texas. (Rep'd. 1960-1961)

TWA Orders 24
Super Connie 1649s

Howard Hughes has ordered 24 additional Lockheed Aircraft Corp.'s jet-powered B-50 Super Constellations for Trans World Airlines. Cost of the new fleet will total \$70 million. First delivery is scheduled for early 1957.

Hughes was interested in Lockheed's Hughes-powered Super Gnome pro model but believed engine development was not far enough along to warrant a contract. He also tested two Boeing Aeromarine Co.'s 787 hp twin-turbos.

Wings will be patterned after Lockheed's C-110 cargo transport and will have the same weight. They will be 27 feet long and 380 square feet greater in area than previous configurations, allowing engineers to be placed further from the cabin.

“The World’s Most Promising Technological Revolution”

The Electronics industry is truly "the world's most promising technological revolution."

Even though it grew phenomenally during World War II, Electronics really came into its own following the war. By 1948, it had become a \$3,000,000,000 business, and was rapidly becoming a major industry.

Today, Electronics is a \$9,000,000,000 industry—covering television, radio, military electronics, commercial electronics, broadcasting, and related areas. There is every indication that by 1960 it will be a \$15 billion dollar industry and \$20 billions by 1964. And it will keep right on growing.

No other major industry will grow that fast in the next decade.

The Armed Services, by far the largest customers of electronic products, spent an estimated \$445,000,000 in 1948 for electronic equipment for communications, navigation, gunnery systems, etc. Today, government electronic purchases amount to \$3,300,000,000 (or 5.3 per cent) of total defense expenditures. Within the decade, this

(Engineers: Sylvania has many opportunities in a wide range of defense projects. If you are not now engaged in defense work, you are invited to contact David W. Currier, Supervisor of Professional Placement, Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.)

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A Good Start

During the last year the Civil Aeronautics Board reached a low ebb in its history. In quasi-judicial position, its partisan rule and legal authority were only dimly understood by the White House. Its authority was undermined by the Commerce Department and its own leadership provided no positive counsel to offset an audience drift.

Under its new chairman, Ross Baker, a former Olds home congressman and Post Office Department solicitor who was drafted by the Republican National Committee to take this important post, there are signs that a reversal of form is in progress. Baker has redefined the impartial role of the Board by blocking majority party political nominees that had to stand 3 to 2, strictly political decisions. He also approved the appointment of Democrat Joseph Adams as vice chairman, a move that restored another Board bipartisanship tradition. Adams, who is both a test and helicopter pilot, is the only Board member with practical aviation experience and should provide wise counsel to the post.

Baker has also spent time exposing the Board's apportionment and authority to the White House staff. He is determined that the Board should regain its quasi judicial status and not be locked around as a political football. We doubt if there will be any more fiascos like the Pacific Route Case during Mr. Baker's chairmanship. In addition, he is making a start on finding methods to speed the Board's extremely slow processes and clean up the backlog of cases that is a heavy burden on economic progress of civil aviation.

Any CAB chairman is bound to tread a tortuous road with plenty of possible pitfalls. Mr. Baker would be hardly human if he avoided any mistakes. But he has pulled the Board out of its doldrums and at all a good start.

Is Aviation Necessary?

The fact that aircraft manufacturing has surpassed the automobile industry in employment, payroll and gross value of product during 1958 has earned a wide voice from the Detroit News in the motor capital. "It is disconcerting," the News says, "to have the auto industry that displaced in the country's premier engineer." The News also notes that the aircraft industry, "would be wholly erased without one lasting harm to the economy," but that "loss of the auto industry, if that were conceivable, would be an instant catastrophe."

We certainly agree with the News that the auto industry occupies a vital role in the U. S. economy, but fail to

understand its present view that aviation is not vital to this country's present prosperity and future growth. We recommend that the Detroit News editorial writers do some investigating before they leap to the silly conclusion that this country can get along without any aviation.

They might ask hundreds of U. S. citizens round the world foods, dispensed and enemy action by helicopters if aviation is necessary. They might ask officials who are air mail, air express and air freight. They might ask thousands of corporations, including General Motors Corp. and executives who own or use aircraft for business purposes. And they might ask the 13 million passengers who rode U. S. airlines last year if coming aviation would make any difference.

Finally, they might take a long look at airports in the Air Force, Army, Navy and Marine and ask if we would have any economy or, in fact, any country at all without the aircraft industry and its products.

UAC's Statesmanship

Another example of statesmanlike approach by an aircraft corporation management to a problem involving the survival of the free world can be found in an advertising program plugging NATO to European newspapers.

This program is sponsored by United Aircraft Corp. It originated during a recent visit of UAC President H. M. Horner to Europe where he attended a briefing by General Alfred M. Grunert, SHAPE commander, at which the point was made that most countries had decided that between 75 and 80% of the people in the 13 NATO countries didn't even know what the initials signified. Obviously these people had not the faintest idea of what NATO is trying to do for them in protection against the menace of communism and military aggression. At this same briefing, General Grunert made the point that while American industry had been extraordinarily successful in telling its product story to world-wide consumers it seemed a pity that this same technique could not be applied effectively at a political level.

Horner took up the challenge and set his staff to work producing a ten-page series of ads that are running in 25 newspapers in 17 key cities of the 13 NATO countries explaining the purpose, organization and problems of NATO. This series has been approved by SHAPE headquarters in Paris.

The United Aircraft Corp. NATO ad series is another fine example of how the marketing management of the aircraft industry is using its growing financial resources to the best public interest.

—Robert Holt

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These and other achievements are solid evidence that the aircraft industry can continue, as in the past, to look to Bendix for creative engineering and quality manufacturing.

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